DOCUMENT RESUME

ED 053 495 EA 003 765

AUTHOR	Fincher, Cameron, Ed.
TITLE	Institutional Research and Academic Outcomes. Proceedings of the Association for Institutional Research Annual Forum. (8th, San Francisco, California, May 6-9, 1968.)
INSTITUTION	Association for Institutional Research.
PUB DATE	68
NOTE	236p.
AVAILABLE FROM	Office of Institutional Research, Claremont University Center, Claremont, California 91711 ($6.00)
EDRS PRICE	EDRS Price MF-$0.65 HC-$9.87
DESCRIPTORS	Educational Finance, *Educational Research, Faculty, *Higher Education, *Institutional Research, Organization, Organizational Climate, *Planning, Research Methodology, *Research Needs, Social Change

ABSTRACT

The theme of the 8th Annual Forum on Institutional Research was "Institutional Research and Academic Outcomes" -- intended as a continuation of the 1966 Forum discussion dealing with academic inputs and the 1967 Forum on the instructional process. After an address by the Association's president in which he urged his academic colleagues to investigate the possibilities for change in both the organizational structure of universities and the educational process, general papers were submitted on the relationship of benefits and costs in higher education; societal impacts on higher education; and educational productivity in economic terms. Approximately 4 papers were presented in each of the areas of: Institutional Planning and Theory Models; Campus Climates; Institutional Innovations; Faculty and the Institution; Methodology and Assessment in Evaluation of Output; Institutional Budget and Cost Analysis; and Synthetic Output by Simulation. Because of space limitations in the Proceedings, some of the 32 papers were condensed from the original and many of the tables, charts and graphs were omitted. (This document previously announced as ED 029 557.) (JS)

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INSTITUTIONAL RESEARCH AND ACADEMIC OUTCOMES

Proceedings of the
Eighth Annual Forum on Institutional Research
Sponsored by the
Association for Institutional Research

Edited by
Cameron Fincher

EA 003 765

THE ASSOCIATION FOR INSTITUTIONAL RESEARCH

1968

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Proceedings of The Annual Forums on Institutional Research
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INSTITUTIONAL RESEARCH AND ACADEMIC OUTCOMES

TABLE OF CONTENTS

FOREWORD

PRESIDENT'S ADDRESS AND INVITED PAPERS

Fact, Doubt, and Myth
L. E. Hull 1

Relating Benefits and Costs in Higher Education
Paul L. Dressel 7

Societal Impacts on Higher Education
Paul A. Miller 19

Educational Productivity in Economic Terms
Charles S. Benson 25

INSTITUTIONAL PLANNING AND THEORY MODELS

Organizational Effectiveness and Institutional Research
Jerry L. Kirks 31

Simulation: A Methodology for Institutional Research
Thomas E. Hoover 39

Establishing New Universities: Implementation of a State Master Plan
Robert H. Fenske 45

Rationale for Using Micro-Analytic Approaches in Predicting the Character and Size of College Student Enrollments
Mary Corcoran and Douglas H. Anderson 53

CAMPUS CLIMATES

Junior College Environment Scales
Vernon L. Hendrix 61

Assessment of Intellectual Change
Sarah Cirese 73

Vocational Dispositions of the Nonconformist, Collegiate Dropouts
David Whittaker 79

INSTITUTIONAL INNOVATIONS

Residential Colleges in a Large University
LeRoy A. Olson 87

Environmental Assessment of an Innovative Cluster College
Jerry G. Gaff 91

A Significant Problem Deserving Study: The Cluster College
H. R. Kells 97

College Roommates: A Study of Interaction and Resulting Performance
James H. Austin, Jr., John A. Lucas, and
James R. Montgomery 101

FACULTY AND THE INSTITUTION

The Reality of Institutional Constraints upon Unbiased Interviewee Selection
M. Frances Kelly 107

Output as a Segment of Organizational Goals
Alan D. Willsey 111

The Reluctant Planner: The Role of Faculty in Institutional Planning
Ernest G. Palola, Timothy Lehmann, and
William R. Blischke 117

Research and Information Reports on the Two-Year College: 1960-66
Louis A. D'Amico and John C. Shaw 127

METHODOLOGY AND ASSESSMENT IN EVALUATION OF OUTPUT

Methodology in Studies of Institutional Characteristics: A Critique of Experimental Design
Walter L. Thomas 135

FD's and SD's--Neglected Data in Institutional Research
Arthur W. Chickering 141

Studies of Institutional Environments: Categories of Instrumentation and Some Issues
John A. Centra 149

A Research Data Bank for Higher Education
Robert J. Panos, Alexander W. Astin, and
John A. Creager 155

INSTITUTIONAL BUDGET AND COST ANALYSIS

Budget Formulas and Model Building
Robert G. Cope 163

Financial Aspects of Interinstitutional Cooperation: Unit Cost in Cluster and Non-Cluster Colleges
Clifford T. Stewart 171

Program Budgeting: A Case Study in its Application
M. F. Severance 181

Systems Analysis for Institutional Output Decisions
Donald C. Lelong and William R. Mann 189

SYNTHETIC OUTPUT BY SIMULATION

Synthetic Output by Simulation
Thomas R. Mason 203

Program-Based Decision Models at the University of Toronto
Bertrand L. Hansen 207

Management Use of Simulation in Long-Range Planning for Colleges and Universities
Collin Scarborough 215

A Model for the Production of College Graduates
Lewis J. Perl 225

Some Experiences with Computer Applications to Campus Planning
Robert W. Koski 237

FOREWORD

The Eighth Annual Forum on Institutional Research was held in San Francisco, California during May 6-9, 1968. The theme of the Forum was "Institutional Research and Academic Outcomes"--a continuing discussion of the 1966 Forum that dealt with academic inputs and the 1967 Forum that considered the instructional process.

In publishing the Proceedings of the Forum it has not been possible to include the clinics or workshops that were conducted on May 6 or the seminars that were held at various times throughout the Forum. The published Proceedings include only the President's address, invited addresses, and contributed papers.

Editing the Proceedings has required the omission of many tables, charts, and graphs. Limitations of space have required also the condensation of many contributed papers. Apologies are due, therefore, to those contributors who will find the published form of their papers modified or altered. I trust, however, that each contributor will still recognize his paper and find that editing has not deleted or obscured the essential content. As editor, the responsibility for all changes or omissions is mine alone.

A publication of this length necessarily requires the efforts of many people. As Editor of the Association for Institutional Research, I should like to express my appreciation not only to those persons who gave invited addresses or contributed papers but also to the many who participated in the workshops or seminars. Special appreciation should be expressed to Mrs. Nina Berkley and Mrs. Jeni Campbell who typed the final copy of the manuscript, to John Muir who prepared most of the charts and graphs, to John Hiers who did the preliminary editing, and to Joseph Moorman who endured the hardships of proofing and assisted in many other ways.

November 1, 1968

Cameron Fincher
Editor

FACT, DOUBT, AND MYTH

L. E. Hull
Director of Institutional Research
University of Indiana

The purpose of this paper is to discuss three related, although perhaps seemingly disparate, topics: the progress of our association, the future of institutional research, and what I see as an overriding concern for higher education which may well shape the future of our discipline.

I shall begin by reviewing the progress our association has made since its inception. The framers of our constitution, Bob Hubbard and his able committee, designed a document which accomplished two purposes: it established a charter for the Association which was so clear that all members could espouse and adhere to it; and it allowed a latitude for the first officers of the Association, headed by John Stecklein and Jim Montgomery, to translate the mandates of the Constitution into effective executive action. These officers have been assisted behind the scenes by a host of members of the association, who have served for the most part without public recognition, in aiding the translation of a document into an organization. The work of these pioneers is evidenced by your attendance tonight.

The accomplishments of the past year are many. The Secretary of the Association, a man who had devoted countless hours of effort in the discharge of his duties, has contributed immeasurably to the growth of the Association. Under his leadership, the Membership Committee has framed guidelines for membership--full, associate, and honorary--which were presented to you at registration. In my judgment, these proposals translate the intent of the constitution committee into workable rules for determining eligibility for membership in the Association.

The duties of the Secretary are arducus and have been conscientiously carried out only through evening and weekend effort and with the assistance of a competent and loyal staff. It is apparent to the Executive Committee that financial assistance must be given to this officer to employ clerical help in the discharge of his duties. The Executive Committee is committing funds from next year's budget for this purpose. And I would submit to you that we are not far from the time when a future Executive Committee will submit for your consideration a proposal that an Executive Secretary be employed to carry out some of the functions now fulfilled on an overtime basis by Dr. Tincher.

The Executive Committee also commends the services of the Treasurer of the Association who, in filling the unexpired term of the elected treasurer, has established a system of fiscal control which not only elicits the approval of our auditors, but more importantly, provides the Executive Committee with regular reports of the exact status of our treasury. After a period of mild recession, if not depression, our treasury has shown marked improvement and is now in a robust condition. Many long hours are also involved in the discharge of the treasurer's duties. To assist him I am proposing to the next Executive Committee that a Committee on Finance be appointed--to be used in an advisory and auxiliary capacity as the Treasurer deems appropriate.

I need not speak of the effectiveness of the work of your Vice-President. The quality of the program in which you are participating and his air of harassment and harried demeanor attest to the work he has performed in our behalf.

The other members of the Executive Committee, the past president, and the members-at-large have faithfully and conscientiously assisted the other officers in the performance of their duties.

You have received the publications of the Association. The Proceedings of the last Forum, under the editorship of Galen Drewry, were scholarly, timely, and extremely well received. Lou D'Amico has kept you informed of pertinent activities and events through the Newsletter, and Cameron Fincher, through some legerdemain, managed to get the second edition of the annotated bibliography into your hands when you registered.

Editing the publications of the Association is a labor of love which largely goes unmentioned and unnoticed. For three years, you have received service from Clarence Bagley, the editor of the Association. Clarence's term of office expires at the end of this year. As you know, the office of editor is an appointive one, and I am pleased to inform you that the Executive Committee has authorized me to announce their appointment of a new editor to succeed Clarence. Cameron Fincher, of the University of Georgia, at least for the moment mentioned and noticed, has agreed to serve as the second editor of the Association.

The Executive Committee appointed this year a committee on monographs under the leadership of Al Cavanaugh. You have seen their report, and I can assure you that it is being given careful consideration by the Executive Committee. I hope you will share your opinions concerning the report with the Executive Committee. Monographs can be expensive. They can also provide considerable enhancement to the image of the Association. The question may be one of expense versus image. The Executive Committee must decide, and your counsel will be appreciated.

Those of you who were at Athens will recall that there was an impassioned appeal for the establishment of a Committee representing the Association to attack the many problems associated with the transmission of data to state, regional, and national organizations. We all recognize that this is a most grevious problem. Responding to Bob Wright's eloquent oratory, the Executive Committee appointed a committee on data standards, and following a time-honored tradition in higher education, asked Bob Wright to chair the committee. This is not a problem to be solved in one year. The Committee is being continued and will present a preliminary report tomorrow.

During the year, the Association was asked to send an official representative to a number of meetings of other professional educational organizations. In addition, responses were also made to send a representative to the inauguration of three university presidents--including that of Dr. Malcolm Moos, coauthor of one of the standard references for all of us. Would that John Stecklein were available to represent us there.

While speaking of our first president, may I report that under his leadership our association has sponsored two workshops for newcomers to the field of institutional research. One, with the co-sponsorship of SREB, was held in Baton Rouge; the other, with assistance from IRCE, will be held in Minneapolis in June. Both were supported by a grant from USOE. Your Executive Committee hopes to extend these workshops next year. Therefore, it is my conviction that our Association has survived its infancy and childhood and is emerging from adolescence. I am well persuaded that the loyal support received from the Executive Committee and from all of you will enable me to provide the next president with a mature educational organization--one well deserving to take its place alongside our colleagues with kindred interests in improving higher education.

Let me turn now to what I see as some developments for our discipline in the future. The role of institutional research is changing. Once we felt that when we had developed expertise in faculty load studies, cost analysis, studies of student characteristics, enrollment projection techniques, and faculty characteristics, we had mastered our craft and had identified the parameters of our field of study. I submit to you that such is not now the case in a number of institutions and will not be the case in most institutions in the future. Let me iterate a few of the functions which I see institutional research beginning to perform and which will be required in the future.

I need not spend extensive time on the whole new field of simulation devices. Your program chairman shares my concern that these new devices be studied and has provided for an examination of them in the program. But just as their significance is stressed by their appearance on the program, I call your attention to them here. The new computers have provided an opportunity to simulate a variety of changes in our institutions and to calculate the effects of these changes in only minutes and seconds. We must identify the components of the educational process, we must learn what relationships exist between and among them, and we must learn how to manipulate them to effect improvements in our institutions. We enter, and some of us have helped to create, a world of simulation devices, mathematical models, program budgets, and opportunity cost analysis. We must learn to live in that world or lose our effectiveness.

Secondly, and again our program reflects our concern with the problem, we are beginning to learn that we must study the impact of higher education on the society it serves. This world, which we are also entering, is a bewildering and somewhat frightening one. No longer will it suffice to say that we made our contribution to society by producing x number of baccalaureates, that we are the bastions of academic freedom, that society has given to us the charge to do basic research, and that in some magic way we provide public service to community, state, nation, and world. If we are to continue to secure the support we require, we must find new and ingenious ways of identifying and reporting our activities, our products, and our impact. Dressel and Benson have said it well; I take the liberty of underscoring their observations.

Before the birth of AIR, at a Forum in Minneapolis, Dr. Francis Horn, then president of the University of Rhode Island, aroused the ire of many in attendance by stating the position that the proper role of institutional research was to give advice to the president and central administration on problems which they were required to solve. Many waxed eloquent (in seminar rooms, corridors, and bistros) and maintained that the proper role of institutional research was solely that of providing objective analysis, not to propose a solution. We are learning that such is not the case. Who is to say "nay" when a president asks: "What do you think I should do"? A long harangue about the necessity for noninvolvement and institutional research as a modernized version of blindfolded justice will send the president packing with a muttered observation about doltishness and perhaps a mental note about a replacement. If we have made an intensive study of a problem confronting our institution, at that moment we know more about that problem than anyone in the institution. To deprive our superiors of the benefit of our advice is a disservice to our institution and to our profession.

As a corollary to our role as advisors to the administration, I see an increasing involvement for institutional research in the creation of policy and planning documents. Institutional research has the overview of the institution which is essential to the development of policy formulation and planning which takes all facets of the institution into consideration. In addition, the institutional research office has another essential ingredient for sound planning--time. The president plans on airplanes and in terminals; the institutional research officer is freed from operational responsibilities and given the luxury of time--time which should be spent in planning.

Just as I see an increasing role for institutional research in advising the institution, I see an increasing involvement in providing advice to outside groups. I predict a steadily increasing stream of institutional research officers on accrediting teams, consulting with institutions (hopefully sometimes with an honorarium attached) on curriculum, data processing, and institutional self-study. Developing institutions, federal agencies, and foundations will also continue to seek the advice of institutional research officers concerning self-assessment and evaluation of programs and policies. Nor will our services be restricted to this continent. In the past John Dale Russell, Paul Dressel, Joe Saupe and others have served as consultants overseas; John Stecklein is currently on a mission to South America; and next month my wife and I leave for two years in Afghanistan, where I will serve as advisor for administrative services to Kabul University. Others will follow.

Finally, let me turn to what I consider an overriding problem for institutional research. I speak of the concern of students and faculty about university governance. We meet tonight just across the bay from a distinguished institution which first bore the brunt of student unrest and rebellion against authority. While we are in conclave, on the other side of the continent another distinguished institution is still in the throes of agony caused by insurgent students.

We may speak glibly of model building, economic output, and program budgeting, but we must never forget that universities are composed of and exist for people. And we must never forget our concern for people. We must learn much more than we know about the people we call students, and the people we call faculty, and the process we call education. To direct your attention to some of the dimensions of this problem, allow me to quote from a few sections of a most provocative book, The Student in Higher Education, a report of a committee appointed by the Hazen Foundation.

> One of the great indoor sports of American faculties is fiddling with the curriculum. The faculty can engage in interminable arguments during years of committee meetings about depth versus breadth. They can fight almost without end about whether educations be providing useful or liberal knowledge. They can write learned books and articles about the difficulties of integrating human knowledge at the time of a knowledge explosion. New courses are introduced, new programs are offered, new departments are created (to quickly become vested interests of their own), sequences of courses are rearranged, honors programs are introduced, teaching loads are adjusted, and a grand and glorious time is had by all.
>
> The harsh truth is that all this activity is generally a waste of time as far as providing a better education for students is concerned. There is no evidence to date that young people learn any more or any less, no matter how their academic curriculum is arranged. The controversy over curriculum gives the faculty something to do and serves their need for neatness and elegance.

> For curricular reform to be effective, it must have as its primary reference point the student and his developing personality. It is interesting to speculate on what model of man many of the more ingenious and elaborate proposals for curriculum reform are based. Many of these proposals leave the impression that the student is a first cousin of Adam Smith's economic man--a rational passive absorber of information.
>
> Despite some external differences (concerning university organization), the organizational structure of many modern higher educational institutions is not terribly different from that of penal institutions, with the single important exception that a student is relatively free to leave the college or university.
>
> The social structure of the school is designed to keep the student away from the important people on campus unless it is absolutely imperative that he talk to them.
>
> For all the lip service paid to personal development in the catalogue, the actual practice in most colleges is to keep matters as impersonal as possible.
>
> The admissions policy, the freshman orientation program, the selection of teachers, the designing of a curriculum and classroom instruction, and the social and physical organization of a typical American college or university pay little attention to the needs and problems of students and the development of the students' personalities. It is hard to escape the conclusion that so long as the students don't sully the public image of their colleges, American higher education really doesn't much care what happens to its undergraduates.

This dramatic and scathing indictment of higher education, both its content and organization, may be too bold. But there can be no denial that we have failed, for at least a segment of our people, to provide a meaningful dialogue about our aims, purposes, methods, and reasons for what we are trying to accomplish for them.

It has become a cliche that only a minescule portion of the student's education takes place in the classroom, and yet we smugly continue to make our studies of average class size, faculty load, and space utilization. If we know that education takes place outside the classroom, why do we not begin to analyze where and how and to what extent it does take place? If we know that peer group influence determines learning and behavior, why do we ignore the pleas of student personnel workers for help in analyzing what goes on in those groups, and what the implications are for adjustments in the educational process? If we know that prevalent and popular organizational structures in higher education may impede rather than enhance the educational process, why do we engage in endless and meaningless debates concerning where the Office of Institutional Research should be located in the present administrative structure?

There must be dramatic breakthroughs, quickly, into the content and organization of higher education. The long hot summer and the winter of our discontent squarely confront the academic community. Inextricably intertwined with the demands of minority groups for a place in the sun and shelter from the snow, the demands of people for changes in the educational process can no longer be ignored by institutional researchers. There can be little quarrel that this is the paramount problem faced by institutions right now, and if our purpose is the help our institutions solve their problems, we must pay heed.

We must learn, and quickly, what changes we hope to accomplish in people. We must learn, and quickly, what kind of people can best affect those changes. We must learn, and quickly, the organization needed to accomplish these changes. I give you a challenge--a major involvement in the major problem confronting our institutions.

On one occasion Dr. Herman B. Wells, one of the great university presidents, had this to say:

> This is a time when yesterday's bright new fact becomes today's doubt and tomorrow's myth. A university must do more than just stand guard over the nation's heritage, it must illuminate the present and help shape the future.

Dr. Wells could have been speaking to us as well. For if there is any mission for institutional research, how could it better be defined than to change yesterday's fact into today's doubt, and tomorrow's myth. I challenge you to illuminate the present, but most importantly, to help shape the future.

RELATING BENEFITS AND COSTS IN HIGHER EDUCATION

Paul L. Dressel
Director of Institutional Research
Michigan State University

A terminology is greatly needed which more explicitly demands examination of the relationships between the values of higher education and the costs. Cost benefit analysis of education is still too rudimentary for use in institutional research studies, but the terminology has implications which merit attention. This paper considers three basic questions: (1) What are the benefits of higher education?, (2) Who pays for higher education?, and (3) How are benefits and costs to be matched? The questions are not readily answerable, but new insights may be attained by the attempt to answer them.

What Are the Benefits of Higher Education?

A realistic and socially responsible answer to this question is required. Colleges and universities state esoteric and idealistic objectives, most of which emphasize the development of the individual. Although the objectives are impressive, the educational experiences actually provided may be unrelated to the objectives. Since the objectives are ambiguous, they are also controversial. For example, good citizenship is a recurring phrase in statements of objectives. An acceptable definition is not readily found, for various sectors of our society disagree markedly as to what constitutes good citizenship. Statements of objectives also emphasize appreciations and other aesthetic outcomes associated with the liberal arts. Again there is no agreement as to their meaning and perhaps not even unanimity as to their value. The observable outcomes, benefits, or values of higher education are in marked contrast with these vague and illusory goals. In turning to the economic benefits of education, we should not ignore education as a means of personal fulfillment, but this latter aspect has previously been overemphasized to the point of being unrealistic and even socially irresponsible.

Means, processes, and functions have been confused with outcomes, benefits, and values. Study of the liberal arts is eulogized as though this were an end in itself. The functions of instruction, research, and service are touted as though these rather than their results justify higher education. The functions arise out of three often reiterated basic purposes: dissemination of knowledge, augmentation of knowledge, and preservation of knowledge. Yet the statement of purposes does not assure their accomplishment, and their accomplishment does not assure their worth. Knowledge itself may be worthless, and research which yields worthless knowledge is a wasteful activity. The question as to what the benefits of higher education really are is well justified.

Who Benefits?

This question raises several others. To whom do the benefits of higher education accrue? Statements of educational objectives usually emphasize individual benefits, but benefits are multifold. Some are highly personal or consumer oriented and accrue primarily to the individual and his immediate associates; others accrue to the geographical or political region, the immediate community, state, and nation. Society benefits; donors and supporters of higher education benefit; and to a much greater extent than is commonly realized, the institution itself benefits. Institutions do demand support to accomplish their own ends and enhance their own stature. The self-righteous and self-serving nature of many of higher education's demands for support generates suspicion of motives and doubts as to the validity of the needs presented.

When Do Benefits Accrue?

Each year of education--indeed each course--may have benefits which accrue immediately to the individual. An individual who completes a course in accounting, statistics, or computer programming presumably has acquired some skills which are immediately valuable to him in his further study. The skills also are economically significant to him and to industry if he takes a job. The immediate benefits of a course in history or literature are less clear because no definite competency ensues from these courses. The individual may gain some personal satisfaction and, of course, the professor earns his pay, but both individuals and prospective employers tend to view such experiences as only a step toward a degree or certificate and as having limited value otherwise. Only completion of the program yields salable competencies, a major one of which is the ability to continue learning as required by new tasks and changing needs. Thus the major benefits of higher education are deferred. Even liberal education benefits which accrue largely to an individual do so only as he continues to exhibit interest in and enjoy cultural activities. The individual's salary improvement resulting from education is spread over his entire working life. The contributions of education to economic growth accrue over the life span of the individuals educated. Since most of the benefits of higher education are deferred, it is difficult to provide evidence which justifies current requests for support. Expenditures for education, whether by the individuals educated or by others, constitutes an investment, but the returns from that investment are not definitely known.

Types of Educational Benefits

The diverse nature of the benefits further complicates the task of relating costs and benefits and leads to the question: What types of benefits accrue from education? Knowledge, attitudes, values, and skills--the usual foci of educational objectives--are not readily interpreted into economic or social values. Many of the skills developed in higher education are also so academic in nature that their economic or social significance is unclear. Study, library, and laboratory skills, except as they are essential parts of some professional program, are not benefits which obviously justify the costs of education. Educational benefits, phrased in terms of capabilities or professional competencies, could have immediate relationships to business and industrial needs and to the needs for skilled manpower. Hence more can and should be done to interpret liberal education as the attainment of a series of competencies or capabilities: communication, problem-solving ability, ability to cooperate or collaborate with others in the study of problems, ability to assimilate new ideas and organize them into meaningful relationships with existing patterns. Such competencies, accompanied by examples of their use, can have apparent and widespread applicability.

Educational benefits range from personal satisfaction to social improvements and economic growth. Some benefits are immediate, others are deferred; some accrue to the individual; others accrue to society. We know little about the relative importance of these categories. The units used in higher education (credit hours, degrees granted) are not useful in measuring these benefits. Occasionally it is pointed out that the college-educated individual earns several hundred thousand dollars more during his working life than the one without such an education. Though this type of evidence may be rejected by many educators, the productivity of graduates is a more realistic appraisal of the value of higher education than degrees or credit hours.

Other economic benefits include such items as economic growth, the meeting of skilled manpower needs (including teachers, researchers, and professionals), and increased incomes and taxes. A more selective and higher level of consumption resulting from education is perhaps as much of a social benefit as it is an economic benefit. The discovery and cultivation of potential talent is a social benefit and also an economic one. The increased capability for adjustment to changing requirements and needs is a personal, social, and economic benefit.

Table 1 exhibits the major types of benefits classified into consumer and producer types and also into immediate and deferred or investment types.

Table 1

A SCHEMATIC ORGANIZATION OF BENEFITS

	Immediate	Deferred
Consumer:	enjoyment of associations cultural opportunities	"taste" and associated societal improvement
Producer:	college work projects cooperative work-study	commodity demand and utilization increased earnings economic growth

The student in college certainly has immediate consumer benefits: he has pleasurable and cultural experiences with other students and with the faculty; he obtains satisfaction from his reading and study. There are also deferred consumer benefits. The student cultivates intellectual and aesthetic tastes which affect his entire life and which contribute also to an improved society. There are both immediate and deferred producer benefits, though the latter far outweigh the former. The college student may, through participation in college work projects, produce goods or services which help to finance his own education and contribute to the operation of the institution. He may engage in off-campus cooperative work programs which are immediately productive. From this work experience there are undoubtedly deferred producer benefits, and there may be both immediate and deferred consumer benefits. A college education yields increased earnings. The student's increase in competency contributes to economic growth as do the research findings of the universities. The increased demands for new and better commodities which result from education also promote economic growth.

Table 2 presents a somewhat crude analysis of the relationship between benefits and beneficiaries. It attempts to relate the various types of benefits already mentioned to the various beneficiaries: the student, the institution, the society, and the nation. The student benefits through personal satisfaction, through social and cultural opportunities, through the acquiring of vocational competencies which ultimately lead to increased income. The institution benefits from improved competency of the staff and from the growth in the institution, both in size and prestige. The adjacent community benefits from the cultural and aesthetic opportunities supplied by the university. There are also political, social, and economic benefits which accrue to the community from the presence of the institution. The state benefits from the constructive utilization of youth time and talent and from the ultimate economic growth. The nation benefits through having a better society and through increased technological growth. The benefits and beneficiaries are interacting and interdependent; hence Table 2 is suggestive rather than definitive.

Table 2

ALLOCATION OF BENEFITS TO BENEFICIARIES

Who benefits?	How?			
Student:	personal satisfaction	social and cultural opportunities	vocational competencies	increased income
Institution:	improved competency of staff, institutional growth and prestige			
Society:				
Community	cultural and aesthetic opportunities; political, social, and economic benefits			
State	constructive utilization and development of youth time and talent; economic growth			
Nation	"better" society; technological improvement			

Some Evidence and Comments on Economic Benefits

Evidence on the economic contributions of education is fragmentary, but a number of economists have attacked the problem. Schultz notes that, as a source of economic growth, additional schooling of the labor force would appear to account for about one-fifth of the rise in real national income in the United States between 1929 and 1957.[1] This corresponds closely with estimates made by others. It may be unrealistic to assume that a 20 percent increase in national income can be credited to education in the future, for much of the earlier impact must be credited to education provided at the elementary and secondary levels. Despite expansion of higher education, it is unlikely that the actual amount of education will expand at the same rate in the future as it has in the past.

The impact of research on the economy is largely unknown. Schultz refers to studies which indicate that investment in hybrid corn research was yielding the U. S. economy, as of 1955, a return of about 700 percent annually, and agriculture research as a whole about 35 percent annually.[2] In recent years large sums of money have been expended on research, but no estimates are available as to the impact on the economy--although in space exploration, pharmaceuticals, medicine, and other fields advances are evident.

Furthermore, Schultz estimates that returns on a college education, including income foregone, are about 11 percent annually.[3] This is a fairly good return rate but certainly not a startling one, for it is matched or exceeded by other types of investment. It may be a low estimate, for, although Schultz and others have emphasized the income foregone by students enrolled in higher education and secondary school, it is doubtful that all of these young people would be profitably occupied if they were not in school. Education undoubtedly does have a baby-sitting function.

The financial impacts of a university on the surrounding community are evident but, perhaps because they are incidental, have been ignored in discussions of the benefits of higher education. Schultz, adding all the input services in higher education to obtain what he calls "factor costs," concludes that 93 percent of the 1956 factor costs can be traced to wages and salaries for human effort.[4] A large proportion of this expenditure is in the immediate community. The economic impact of the expenditures of a multimillion dollar university deserves some study. The university generates business activity which provides employment and produces income. The taxes paid would not otherwise be available and so, in a sense, the university generates part of its own appropriations.

It is evident that many different benefits accrue from higher education, and that these benefits accrue to many different individuals and segments of society. It is evident, too, that we know little about the dollar value of these benefits in relation to those who pay for higher education.

Who Pays for Higher Education?

Table 3 indicates the sources of higher education financing and the nature of the financing provided. The student not only pays for his higher education through fees, room, board, and incidental costs, but also through income foregone. The latter is an opportunity cost which Schultz estimates as 59 percent of the total cost of education.[5] Although the reality of income foregone, to the extent of Schultz's estimate, is debatable, there is no doubt that enrollment in higher education requires sacrifice of other opportunities.

Individual donors contribute cash, facilities, real estate, equipment, and scholarships. Foundation grants, though at times for general support of an institution, are not unalloyed sources of assistance, for they primarily encourage innovative programs of instruction, research, and service, with the expectation that the institution will ultimately continue them. Churches provide support for education, primarily in private denominationally related colleges, through annual allotments, special gifts, and scholarships. Business and industry are sources of some unrestricted funds as well as of special gifts designated for particular programs, facilities, research, service, and scholarships. Governments (local, state, and federal) provide extensive support to all of higher education, private and public, through tax exemptions. Public institutions are supported through annual appropriations for operations and capital expenditures, and, to some extent, through appropriations for special projects and special services. The federal government has become an increasing source of support for both public and private institutions. A few private institutions obtain more than half of their annual income from governmental sources. Some few public universities raise millions of dollars from private sources. The distinction between private and public higher education is rapidly blurring; each receives support from many sources and differs in proportion rather than range.

Table 3

SOURCES AND NATURE OF HIGHER EDUCATION FINANCING

Who Pays?	How?
Student:	income foregone (59% of total costs of education, Schultz, p.29), fees, room and board, incidental costs
Individual donors:	cash gifts, facilities, real estate, equipment, scholarships
Foundation grants:	cash, support of innovative programs of instruction, research, service
Church:	annual allotments, special gifts, scholarships
Business, industry:	cash, special gifts, special programs, research, service, scholarships
Government: Local State Federal	tax exemptions, annual appropriations, capital funds, special projects, services

One source of income for higher education is not listed--the institution itself. To the extent that the institution directly produces and sells commodities or owns enterprises that do, it produces income to support its own activities. However, there is no hope that higher education will support itself. Research contracts, at best, hardly pay their own way. Football, often regarded by small-college presidents as a major source of income in universities, is usually subsidized heavily from other sources. The argument that faculty members support higher education through the low salaries which they are paid is now seldom heard. Higher education has multiple sources of support, and there is no clear correspondence between source and purpose. Herein lies a major problem.

How Are Benefits and Costs to be Matched?

Benefits and costs are not easily matched. The first difficulty lies in the extent or the range of benefits. Some of the benefits are intangible. How is one to appraise personal satisfaction in dollars or any other units? The social and political benefits of higher education and the more selective literary and artistic tastes are no less difficult. Those who emphasize liberal education talk in terms which make it impossible to relate education to costs. Those who emphasize vocational education sometime see its benefits solely in the immediate competencies of the individual rather than in long-term economic benefits and growth. Personal gains rather than public gains have been emphasized in most discussions of the benefits of higher education. Persons who argue that it is the individual who benefits and therefore the individual who must pay have no doubt been listening to educators.

A second difficulty in matching benefits and costs is found in the deferred nature of the benefits. Education is largely an intermediate good. Whether viewed in reference to the individual or the state, education is an investment, the benefits of which are realized at some later date. In a nation of highly mobile people the deferred nature of the benefits is further complicated by the obvious and increasing irrelevance of state political boundaries. State legislatures resist supporting students from out of state. Fortunately, there has yet been no scrutiny of continuing residence in the state of the graduates. Support of research, which has never really been accepted by state legislatures, faces a similar problem. Some types of research have significance within a limited area, but seldom is this area coincidental with state boundaries. A complete university is a national resource, and it is increasingly difficult to justify much of the university activity to those who demand that benefits be immediately and tangibly related to support.

A third difficulty in relating benefits and costs is that many benefits are produced simultaneously or jointly. Graduate instruction and research are so intimately related that any attempt to separate either the time of the individuals involved or the financial support is virtually impossible, and the results are completely arbitrary. Grants for research impinge into support of instruction and service. Faculty members and their students may become involved in service activity as an extension of an academic experience. It is, therefore, difficult to relate sources of income to the functions carried on by a university.

Because of these difficulties, cost benefit analysis will, to a considerable extent, be judgmental rather than exact. Nevertheless, we should be as exact as possible. The usual evaluation and research of higher education activities have not even attempted to relate the various types of benefits of an educational activity to the sources of funds supporting it. It is not surprising that there are attempts to impose upon higher education some more realistic means of appraising its benefits in relationship to its support.

Program and Performance Budgeting

Program and performance budgeting is not a corollary of cost benefit analysis, but it is related in the sense that a major purpose of program and performance budgeting is to connect fund sources, expenditures, and accomplishments. Program and performance budgeting, then, provides the basis for appropriation requests. A direct relationship between fund sources and accomplishments is not easily established in a university. To do so requires that expenditures be organized or aggregated not only with respect to sources of funds but also with respect to function and accomplishment. The lack of a clearly defined and accepted end product or accomplishment focus one on activities. The efficiency and effectiveness of activities for which the end results are unknown are always suspect. Hence this approach to budgeting raises questions which higher education is not prepared to answer. Program and performance are not equivalent terms. A program is forward looking; it specifies what is to be done and what is required to do it.

A program budget represents a composite or aggregate of activities and needs at the operational level. Programs may be at various levels of specificity. Each program should have identifiable products, and it should be relatively independent of other programs. An undifferentiated liberal arts college could reasonably regard instruction as a single program producing baccalaureate degrees. A university will need to consider instructional programs by level and type: undergraduate engineering, medical education, and others. Even so, at the operational level the performance of the tasks required for the program involve many different departments and supporting services. Each unit must analyze its performance on the basis of past activities and on the basis of university program planning and project its needs for expansion or continuation of that performance. Requests for increased funds should indicate whether these are required because of more activity at the same level, new activity, or increased costs.

The desired consequence of this approach is that specific operations, ultimate objectives or accomplishments, and costs can be related. Presumably quantitative data of work performed, of accomplishments, and of costs can be provided for each program. Alternatives or "trade-offs" should become visible when support of all programs is not forthcoming. For higher education, the desired consequences of program budgeting are not easily achieved. The outcomes are many, they are interrelated, they are often performed jointly, and the most significant benefits are deferred. A city department of sanitation can estimate the number of tons of garbage to be collected and the equipment and manpower costs can be determined on the basis of past experiences. Garbage collection is readily accepted as essential. Assuming no political pressures or corruption, an efficient operation can be planned and its costs readily determined. The department in a university presents a more complicated situation. It expends money for salaries, equipment, and supplies. These are utilized in a variety of activities: teaching both its own students and those of other colleges and departments, research, advising, curriculum development, and others. Neither the objects purchased nor the activities carried on correspond directly to the end products. Data on such items as class size, instructional organization, use of faculty time, research papers published can be collected, but these data are neither related to fund sources nor to actual benefits. The worth of a credit hour, of a degree, or of a research paper is unknown and perhaps undeterminable. The suggestion, then, that there may exist more efficient or more effective alternatives is not readily refuted. The activities in a university are organized on the basis of tradition or personal preference, with very little evidence or apparent concern as to whether they are either effective or efficient. Studies of class size generally show no significant difference in results of large and small classes. Nevertheless, faculties usually resist changes and increase class size or introduce educational technology only reluctantly as they are forced to do so by the available funds. Those who provide the funds are not greatly impressed by the reluctance of faculty or administrators so long as the institutions continue to take more students and add new programs despite predictions of all manner of dire results in the face of inadequate support. Institutions do not forego desired programs because of lack of support. A notable example is found in the increase in Ph.D. programs in institutions, even when no additional money is available. Large freshman classes taught by graduate assistants suddenly become acceptable and effective, although professors formerly argued that they could not teach classes of more than twenty-five students without serious loss in quality. Undergraduate education suffers while graduate education expands because the faculty and the institutions want it that way. Perhaps the major benefits of higher education really do accrue to the institution and the faculty! Few other organizations in society have the autonomy in program development and in program performance which is found in the university. Much of that autonomy is essential, but there is some justification for suspicion that this autonomy is occasionally abused.

Thus institutions generally resist program and performance budgeting and especially the exhibiting of alternatives or "trade-offs" as an unreasonable incursion into the autonomy of an institution. A university acts as though it should decide what to do as well as how to do it. But it then expects someone to pay the bill. This is unrealistic. The one who pays the fiddler has some privilege in calling the tune.

An Approach to Program and Performance Budgeting in the University

Table 4 suggests a program and performance budgetary pattern, and it indicates analyses that need to be made if that approach is to be effective. The outline considers one of the major functions of higher education--that of instruction. Instruction is the function which emerges from the accepted purpose of disseminating knowledge. This function may not be the most useful for program analysis but, since it is a traditional and accepted one, it should be investigated carefully. This function can be broken down into a number of specific programs: undergraduate, graduate-professional, and graduate. These levels are more appropriate in relation to identification with benefits than are the departmental and college units. The undergraduate program can, in turn, be classified into more specific programs or curricula offered to undergraduates, and we then see that many different departments and even a number of different colleges may be involved in any one undergraduate program. Instruction is but one of the functions carried on by departments, and the courses offered in a department are but building blocks in a total curriculum. The curricular program, as a whole, is more nearly related to ultimate benefits to the student and to society than a particular course.

Table 4

AN OUTLINE FOR PROGRAM AND PERFORMANCE BUDGETING

Function:	Provision of instruction:	
Program:	01.1	undergraduate
	01.2	graduate-professional
	01.3	graduate
Performance:	01.X1	classroom instruction
	01.X2	laboratory instruction
	01.X3	independent study
	01.X4	direction of field study and graduate research
	01.X5	advising
	01.X6	curriculum development
	01.X7	maintenance of faculty scholarship
Objects of expenditure:	01.XY	(a) personal services
		(b) materials and equipment
		(c) other expense

To carry out the instructional function, departments perform such activities as classroom instruction, laboratory instruction, and independent study, each of which may contribute to several programs. One item included in this analysis of the instructional function is graduate research--the research of graduate students and the research of faculty members carried out in cooperation with and in relationship to the graduate program. Maintenance of faculty scholarship is also included, for some research and research-related activity is essential if a faculty member is to maintain adequate mastery of a rapidly changing field of study. Contract research and specific research projects unrelated to the instructional program would not be included under this instructional function. The distinction is difficult, but it is necessary if activities and benefits are to be related to sources of support.

Direction of field study may appropriately include some service activity for the faculty member to the extent that such activity is necessary to maintain faculty competency. However, major service activities of the university constitute another function related to another purpose and to other programs. Service programs will yield different benefits than instruction, and they may be supported by different fund sources. However, the performance activities involved in instruction are sufficiently inclusive that a number of different fund sources may be involved in their support.

Last in the outline are the objects of expenditure, each of which is a subpoint under each performance area which, in turn, must be included under each program area. Presumably, each of the items (personal services, materials, equipment, and other expense) could, on the basis of estimate and judgment, be indicated and the dollars involved ascribed to various fund sources. Once this is accomplished, it would then be possible to aggregate across the several programs.

If these instructional programs are viewed as curricula or degree programs, the analysis is not immediately related to the departmental organization. Departmental and college expenditures could be provided only if the performance area were subdivided according to the activities of various departments and service areas of the university. Conversely, the budgetary request from a department based on this analysis would require a department to consider its instructional services in reference to each of the various categories of students served. Most departments could not do this without extensive assistance and data not now in their possession. Such analysis would serve to dramatize each year the major service role of some departments. It would prevent the situation which develops when a change in curricular requirements shifts a major instructional burden from one department to another without any information as to the financial considerations involved.

This example suggests that program and performance budgeting and, in turn, cost benefit analysis could be turned to internal use as well as to stressing the needs of higher education in the United States. However, the task of relating income, expenditures, functions, programs, and ultimate benefits in higher education is extraordinarily difficult in higher education. It is not likely that a completely satisfactory analysis can be obtained, but even incomplete efforts may pay significant dividends in understanding and interpreting higher education to those who support it.

Footnotes

1. Theodore W. Schultz, The Economic Value of Education. New York: Columbia University Press, 1963, p. 11.

2. Ibid., pp. 39, 40.

3. Ibid., p. 62.

4. Ibid., p. 35.

5. Ibid., p. 29.

SOCIETAL IMPACTS ON HIGHER EDUCATION

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Colleges and universities like to think of themselves among the movers and shakers of this world, and, to a considerable extent, they are. Even before we had developed the modern tradition of professors in government and government veterans in professorships, the campus was an unmistakable force in our national life, making itself felt through both the ideas and the people it sent forth. Today, more than ever, we find this to be true. It is within the orbit of the colleges and universities that new theories are born and new trends crystallize. And it is there that more and more of the nation's leadership in every field is intellectually formed.

Yet higher education is as much the creature of society as its creator. Not only is it the repository of the attitudes and values that shaped the past; it is also a sensitive barometer of what is currently happening in the surrounding society.

Thus institutions of higher learning in the United States today are quite different from what they were a generation ago, not simply because they have followed their own most prescient innovators in new directions but because they have changed under the impact of changes in American life and American thinking.

First, they reflect a whole series of new national commitments--notably to scientific research, to mass education, and to education as a vehicle of community service. Most of these commitments have come to be linked with the presence of the federal government in the cost structure of higher education.

The usual revenue sources simply have not been able to keep pace with the onward march of costs. Institutions of higher learning raise tuition fees again and again. They call on the alumni for endowments and on the foundations for grants. But there is never enough money. Even among today's affluent parents, not very many could meet the kind of tuition bills that would be necessary if colleges and universities had no other income. As for private contributions, there are too few millionaire alumni to go around, and even the foundations cannot meet every need.

We could stay within such strictures if we were willing to give up the idea of higher education for all who can profit from it, and turn our institutions of higher learning back to an economic elite. But our society is not willing to do this. We are against it for reasons of egalitarian idealism, and we are against it for reasons of national self-interest, knowing what we know about education as a factor in economic growth and as a component in our total strength as a people.

Most thoughtful people answer that the federal government must fill the gap. All the other possible sources are too limited. Ford Foundation President, McGeorge Bundy put it succinctly when he said, "It is only those who do not count the zeros who confuse the Ford Foundation with the federal government. . .we cannot take its place."

All in all, in the past four years, the Congress has approved more than 40 laws to support education from the preschool to the postgraduate level, raising

18/19

its outlay to nearly $12 billion a year--nearly three times what it was four years ago.

While the costs of higher education have increased--a threefold increase in the last ten years--the federal contribution has increased even faster, until it is now almost seven times what it was ten years ago. If, in the next decade, there is even a twofold further increase in the federal contribution, it will account for a third of the projected expenditure of $25 billion.

Some people think the federal share may rise even higher. President Alan Pifer of the Carnegie Corporation, speaking to the Association of American Colleges not long ago, hazarded the possibility that the federal share of support for higher education might reach the 50 percent mark by 1975.

Whether or not it goes that far that soon, it seems safe to say that government ties with higher education are here to stay, and likely to assume even greater proportions than they have now. The President's recent message to Congress on education stressed the nation's growing reliance on institutions of higher learning:

> Now we call upon higher education to play a new and more ambitious role in our social progress, our economic development, our efforts to help other countries. . . increasingly we look to higher education to provide the key to better employment opportunities and a more rewarding life for our citizens.
>
> As never before, we look to the colleges and universities--to their faculties, laboratories, research institutes, and study centers--for help with every problem in our society and with the efforts we are making toward peace in the world.

All this is to be done, the President's message says, while guarding the independence of private and public institutions. This brings us back to the first questions. Is this just a pious hope, in danger of being shaped unduly by all the projected federal programs now coming into being, or is it something we really can do: to use the federal government as a device for putting resources into higher education and yet keep higher education from becoming merely the creature of the federal government? I think this _is_ something we can do, but not without thought and planning and a rigorous inventorying of values on all sides.

I say this fully realizing that society and institutions of higher education have not always understood each other when they tried to work together. The federal relationship again helps us understand it. For example, there have been occasions when university people involved in the technical assistance program have found themselves at odds with their colleagues in AID. Sometimes it was over small irritants--academic impatience with the bureaucratic need for defining and measuring and reporting on the activities undertaken, for example. Sometimes the problems were--or at least seemed--more momentous, like clashes over what should be published and when--an issue of academic freedom from one vantage point and of irresponsibility from another.

I know, too, that there have been sober doubts raised about what government sponsorship of scientific research and development is doing to the universities. It has been said that the influx of federal money weakens institutional integrity even as it adds to their intellectual versatility. It is said, too, that a significant portion of the intellectual talent on a campus so subsidized is alienated from the life of the university as a whole, its loyalty to the institution tempered by the government tie.

These are all serious considerations--serious, but not, I should think, decisive. It seems that we must begin our thinking with a recognition that perfect freedom in this sphere is no more achievable than any other perfection in any other sphere. With appropriate cooperation, government and higher education will each be stronger, yet each may be less independent of the other.

What, then, does society ask of higher education in exchange for the financial backing it proposes to give through the federal instrument?

First, it asks a commitment to excellence. Obvious as this sounds, it is not without its own built-in problems; for, to be truly excellent, higher education must be appropriate. It must represent discerning approaches to well-chosen goals. In other words, there must be some searching analysis of an old problem--education for what?--before any endorsement of "excellence" will be very meaningful.

Here the same sort of criticisms can be leveled at both higher education and government. Each is made up of continuing entities with the consequent opportunity and obligation to take the long view. All too often they do not, however. Government responds to prodding from this group or that; it holds off a crisis here and assuages an emergency there, but coordination--long-range planning--is difficult to come by. Efforts are likely to be piecemeal and projects unrelated. Governmental action, which is so significant a determinant of the future, often appears the captive of an eternal "now," responding to the demands of the moment almost exclusively.

Institutions of higher learning, on their side, have a similar tendency to react rather than to act. Not infrequently, they derive their policies from the many small pragmatisms of day-to-day living, allowing the availability of grants, say, to be more influential than reasoned judgments about where the institution really wants to go and the best way [illegible] get there. Perhaps the academic world should not let the students have all the identity crises; perhaps the institutions have a comparable need to find out who they are and what they want to be.

One thing is certain: the clearer the thinking about roles and purposes on both the government's side and higher education's side, the more freedom there will be--freedom for colleges and universities to realize their unique potentialities, each in its individual way, and freedom for the federal government to perceive and do the will of the people it represents.

There is a dual responsibility involved. Government, which will decide so much by where it puts its money, must have a policy. The academic community must do its part in the shaping of such a policy. In his message on education, the President called for a "strategy for higher education" and emphasized the need for a period of open discussion in which the many voices of higher education would make themselves heard on the new directions to be taken.

How shall we fit together public support to students and public support to institutions as wholes?

How can institutional support be adapted to large and small colleges and universities, graduate and undergraduate, private and public, strong and weak?

How may invention with an eye to affecting economies be encouraged in institutions of higher learning without intruding upon distinctiveness?

How can the federal government avoid subsidies to mediocrity?

How shall we face a better distribution of competence in the nation, yet advancing those great centers of higher learning that we already have?

With larger federal support, how best may the assistance of states and private patrons be maintained and encouraged?

And how may federal support help our colleges and universities to become more relevant centers of education and cultural improvement in the larger community?

These are among the many questions that must be discussed openly and freely as HEW moves to respond to the President's call for a new strategy for higher education. The federal government's request for cooperation of colleges and universities in educational policy-making is supported also by the new policy research program being sponsored by the Office of Education. The Office of Education, having started with Syracuse and Stanford Universities, may underwrite other centers for policy studies concentrating on four major questions: What will society require of schools in the future, and how might schools begin to prepare for these new demands? What should be the curriculum objectives now and in the future, and what are their implications for schools and colleges today? What resources will be available to our institutions in the future, and how might this affect planning today? What technologies will be available to these institutions in the years ahead, and what should this mean in terms of present activity?

In a real sense, this is a new departure. The educational enterprise is being asked to study itself in a systematic way. Half a century or so ago, Thorstein Veblen turned his caustic mind on colleges and universities, analyzing them as appurtenances of an industrial culture. Too little has been done since then to explore systematically how American higher education serves as one of the pivotal centers of social life.

With higher education assuming ever greater proportions as a factor in our national life, it is important for us to know all we can about how it fits into the dynamics of community functioning. Here we confront the second requirement the federal government wants institutions of higher education to fulfill in exchange for its investment in them--an appropriate commitment to public service.

Far from wanting to dominate higher learning, the federal government must help it to become more engaged in the central processes of society. This is not to say that colleges and universities should take over the responsibilities of government. The function of higher education is not to build subways or run the police department but to help people understand something of the possibilities and limitations of civic life as expressed through social, political, and economic institutions. Educational service in the modern community does involve helping to alleviate felt needs, but its more important aspect has to do, first, with defining and analyzing public needs, and second, with teaching the discipline of civic choice-making which, in the end, solves, or fails to solve, society's problems.

Turning the view to institutions that make up the academic community in America, one finds a certain aloofness, a certain unresponsiveness to the surrounding society. Partly, this is a matter of status--up to now, nobody has been very willing to reward college and university people in turning outward to community work.

More importantly, I think it reflects gaps in the civic infrastructure. There is a lack of established linkages between the institution of higher learning and the modern community. It is not just that town and gown look on each other any longer with a certain skepticism; a more important problem is the number of institutional anachronisms we are still trying to work with. We, with our 20th century problems, are forced to look for solutions in a world of 19th century institutions. I am talking about very specific things--about the frustration of trying to tackle essentially metropolitan problems with revenues drawn from many competing jurisdictions, for example; a body politic divided into more than 90,000 local units of government and widely varied states; personnel systems still frequently oriented to patronage systems of the past; and the rise of cities to strain the concept of federalism--are all issues of the public process within which the university is somewhat unsure of its place.

The disorganization of the modern city is, of course, the contemporary challenge point. It is a challenge point where the proper offices of government and higher education converge. Government, which is charged with doing for its citizens what they cannot do for themselves, confronts incontrovertible needs for action in the chaos of the urban ghettos. And the institution of higher learning--if we conceive of it as the vital center in the process of discovering, organizing, and distributing knowledge, has an obligation in the crisis of the cities as compelling as that of government.

The colleges and universities are not thus called upon for anything outside their own best tradition. It was, after all, a classicist who said that "the proper study of mankind is man." Everything we see in the furious currents of modern life serves to point up the relevance of Pope's epigram. We do not know all the answers when we ask ourselves: education for what? Nevertheless, we can agree that one identifiable purpose of academic activity should be the achievement of insight into the nature of man and society with a view to bettering their condition. And, for this moment in the history of the United States, we all know that this means turning our intellectual energies toward the examination of the great gulfs in the national community between races, between economic levels, between cultural groups.

What we need to develop is a macro-approach to the study of higher learning in society. Higher education has become too large, too powerful, too central in our culture to afford the unselfconsciousness of its earlier days.

Several areas of research under this rubric suggest themselves immediately:

---There should be a close examination of higher education as a force in the national economy and of its specific impact on the areas where colleges and universities are located.

---There should be intensive analysis of the academic community as a political force. How much do all the demonstrations add up to? What else do academic people do that might affect the course of the nation's political life? How much variety and how much conformity is there from school to school and from department to department?

---How much does the university or college change the student's ways of thinking from those he had as an entering freshman? What are the present connections between higher education and vocational effectiveness?

---What present linkages are there between the academic community and the society around it? What new connections can be developed between the two?

---What is the real nature of the connection between higher education and government? How do they divide power between them now that the federal contribution to the support of higher education has grown so large?

These are only a few of the issues that might usefully be examined to promote self-understanding on the part of our universities and colleges. The role of higher education in society is changing so rapidly that there will be a need for continuing programs of research in which higher education writes and rewrites its own job description and its own efficiency report.

If they are not undertaken, the splendid conception of a knowledge-centered society will rise to mock us with the futility of any resource used without direction and purpose. But it is a splendid conception and a resource which, used with direction and purpose, can change our world.

The interaction of society and higher education is a never ending process. The problem for each in the process is to contribute something relevant to the other to receive its support in turn; and the way to relevance is through self-understanding. When society knows what it wants from higher education, it can ask for it with the hope of satisfaction. When higher education comprehends its own assets and liabilities, problems and processes, it can cease to be the disorderly spectator it sometimes appears to be in the life of the national community and be instead the central clearinghouse for all that is best and most potent in the culture.

EDUCATIONAL PRODUCTIVITY IN ECONOMIC TERMS

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To speak of productivity is to speak in economic terms. The economist is concerned with growth in the capacity of a country to supply itself with goods and services. Hence, he distinguishes among alternative streams of capital investments with respect to their productivity-increasing potential. For example, expenditures in the transportation, power, and machine tool industries traditionally have been seen as broadly increasing the productive capacity of those other firms that supply certain of our immediate daily needs. As is well known, the list of investment expenditures has recently been extended--in the minds of most economists--to include what university and college budgets support, namely, research and teaching. The statistical relationship between national output, on the one hand, and labor and conventional capital goods, on the other, suggests strongly that productivity advances in our country spring substantially from advances in technology. Advances in technology in a highly developed economy are, generally speaking, research based.

Similarly, census data reveal that persons with higher levels of education, i.e., more years of schooling completed, receive higher incomes, on the average, than persons with lower levels. Most household income is earned income, so these education-income differentials cannot be explained away as being returns to past savings by households. Presumably part of the income differentials are associated with differences in the work capacity of the individuals, and presumably part of these differences in work capacity are created in institutions of education (i.e., they are not solely attributable to inborn ability differentials or to the access to higher paying jobs that middle-class parents seek to provide for their children). On both the research expenditure and the instructional expenditure sides, higher education, accordingly, represents a set of institutions the products of which raise the future productive capacity of industries generally.

But the economist is also interested in efficiency, which is to say he is curious about how well any economic institution is managing its affairs. To speak of productivity is to speak of a ratio between some measure of products and some measure of inputs. Increases in productivity occur as the volume of outputs of a given quality increases more rapidly than consumption of inputs of a given quality (or as quality of outputs is raised relative either to quantity or quality of inputs, and so on). If we had reliable, consistent measures of university outputs and inputs, we could easily compute productivity measures that would reveal the relative efficiency of different institutions and of a given institution at different times. It is a big "if."

A Degree Model

One possible measure of educational outputs is degrees (or diplomas or certificates) granted. This act of granting degrees commonly symbolizes the formal completion of a prescribed sequence of learning operations; in most cases it can be assumed that the holder of a given type of degree has acquired certain work capacities that the nonholder lacks. One possible measure of educational inputs is student time.

Using these two simple indicators, together with some financial data about which I will speak later, the University of California Advisory Mission was able in the summer of 1967 to prepare a statement on the relative efficiency of different universities in Colombia. During the first part of its stay in Colombia (which commenced in late 1965) the members of the Mission, working with their counterparts in the Colombian Association of Universities, had collected data on the degrees earned by students in the 69 universities (excluding seminaries) of the country for the period 1960-65. These degrees were listed by specialties (we would say "major," or "professional fields") of which there were 125 in 1965. Furthermore, data were collected for enrollment by year of program, by specialty, and by university for the period 1960-66.

The enrollment figures in 1960 and 1966 were used to prepare a beginning and ending inventory of "goods in process." That is, in the first year and the last of our base period we recognized that the university systems contain students on whom partial investment has already been made. To compute the inventory we gave all first year students a weight of zero (to indicate that less than a year's investment had been accumulated), second year students a weight of one, and up to a weight of six for the students entering the seventh year (only the programs in medicine extended to seven years).

Our output measure consisted of two parts: the ending (1966) inventory and a weighted count of all degrees earned 1960 through 1965. The degrees were weighted by the average length of the degree program, e.g., seven for medical doctors and two for nurses. The input measure consisted also of two parts: the beginning (1960) inventory and the count of student years of enrollment. (In measuring input, one technical adjustment was made: students who enrolled for the first time in the last year, 1966, of the given time period were not counted because these students could not possibly appear in an output measure; all others could, either as graduates or as part of the ending inventory.)

If the universities had zero wastage of students (called "desertion" in Colombia) and if the universities added no new specialties during the given time period, then the volume of output would have been equal to input. Actually, we determined that the excess of inputs over outputs amounted to 68,185 student years. This was 26.7 percent of total inputs (enrollment plus beginning inventory). This is not a shockingly high figure, but high enough to give some weight to our arguments that the Colombian higher education system was being bled by student desertion and by proliferation of universities and specialties.

Also, we computed input/output ratios for the individual universities. Among the larger institutions, the ratios ranged from 3.0 to 1.1. These ratios served as a basis to raise questions--not, of course, to answer them--about why certain universities were more economical with student time than others.

This kind of analysis is based on two assumptions: there are no important differences in quality of degrees granted by different universities, and years of education which do not culminate in a degree have zero value. Both of these assumptions can be subjected to empirical study, as I shall indicate below.

We should, of course, consider also the important matter of the value of given types of degrees to the economy. In Colombia, simply because we had the figures in hand, we were able to pose the question of whether it was good educational policy during the years 1960-65 that the country produce nine graduates in mathematics as against 657 in architecture. Such a distribution may be elegant, but in a developing country it may also be feckless. The productivity of educational institutions, then, is a broader matter than the production of degrees relative to the consumption of student time; it embraces as well the congruences of the types of university products to the needs of the society for educated manpower.

The Manpower Emphasis

Moreso in countries overseas than in the United States, there is reliance on manpower analysis in educational planning. The techniques are now familiar enough. The analyst makes estimates of the occupational distribution of the labor force in a target year, commonly 15 years ahead, having first taken account of the projected size of the labor force and of the projected increase in gross national product. Occupations are translated into educational prerequisites, and an estimate is obtained of how many people in the future labor force should have various amounts and kinds of schooling. Next, the analyst estimates the extent to which these future demands for educated persons will be filled (a) by people already in the labor force, and (b) by persons flowing through the school system under the assumption that no changes in educational policy are made. The final shortages and surpluses of particular kinds of education indicate what changes in policy are required so future demands for and supplies of educated persons are closely matched.

Manpower analysis, of course, is not an exact science. Manpower analysis is not claimed to be the sole guide to education policy. But it does serve to indicate the appropriateness of particular kinds of educational investments, i.e., it can raise the productivity-increasing capacity of the education system to a higher level. It takes us a step beyond the "degree model" I sketched earlier in the sense that we ask ourselves not just how economical a university is of student time in producing degrees, but also what is the relative economic value of one kind of degree against another. Are not, for example, mathematicians at least of equal usefulness to a society as architects?

As I indicated, manpower analysis has not been used much in the United States as a guide to educational policy. In California, we feel fortunate that Professor Nicholas DeWitt has just completed for the State Committee on Public Education the study Manpower Guidelines for Educational Policy Planning in the State of California. This is one of the very first manpower studies done for a state government to guide state policy on education. Let us quote briefly from the report:

> One of the major problems in the State of California is that although the rates of access to post-secondary education are high, the actual output of graduates from both the public and private systems of higher education in the State remains considerably below requirements. . . low rates of success have direct relevance for policies concerning post-secondary education. . .and bear an indirect implication for educational policies in the public primary-secondary schools. . .it is evident that the output of college graduates from the California system of higher education in the 1950's was able to meet the needs of the State by only two-fifths. . . .Even if the optimistic projections for higher education materialize, only about one-third of the gross demand for higher graduates will be met by California institutions of higher education in the 1970's.[1]

Obviously, past shortfalls have been met by in-migration. California has relied on the educational systems of the other states for its educated manpower. However, there are indications that the net in-migration of highly educated persons is tapering off. Hence, DeWitt proposed that California begin to prepare for educational self-sufficiency.

The Specific Values of Years of Higher Education: Follow-up Studies

Neither the "degree model" nor conventional types of manpower analysis tells us anything useful about changes in quality of degrees granted by a given institution nor about the value of schooling that does not lead to a degree. In part, these values are not subject to observation in that they rest in the subjective consciousness of the possessor. Yet, the relative economic significance of years of schooling in different institutions and of degrees earned is subject to measurement. What is required is a continuing series of "follow-up" studies, under which the positions, earnings, and opportunities taken for further study of college graduates and college dropouts are scrutinized. A number of the pieces of such an information system are now in existence: Project Talent, including data to be collected in 1970; alumni records of colleges and universities; the occupational and salary studies of the National Science Foundation; Armed Forces, Veterans' Administration, and Social Security records. These sources could be supplemented by cross-section samples of education and work records, behavioral measures (such as propensity to continue one's education by informal means), achievement tests, frequency of unemployment, geographic mobility, political participation, community involvement, and cultural preferences. But special interest would be attached to the first items mentioned: education and work records, with work records indicating income as well as status. Among lawyers, for example, one would need to distinguish between those who become partners of high prestige firms and those who work in neighborhood real estate and income tax offices.

The persons studied would be identified with their institutions of higher education and account taken of whether they completed their degree programs or dropped out. Account would also need to be taken of the characteristics of students at the time they entered college. In a sense, these follow-up studies would reveal something about the quality of degree programs in different institutions. Realistically, it might be said that they will help define the nature of the different institutions of higher education so useful comparisons among institutions can be made.

Finally, it should be possible to obtain figures on current expenditures, net of organized research, plus a depreciation allowance for school plant, accumulated over a period of years, and to compare the shares of resources consumed in given institutions with the shares of output produced. As a first approximation, output could be measured as in the "degree model" mentioned above. This comparison of shares of resources consumed and shares of output produced was an exercise we carried out in Colombia. Some of the institutions that were quite wasteful of student time were economical with respect to purchased inputs, though this relationship was not consistent among the whole group of institutions.

A Combined Assessment

If investments in higher education are to be regulated in better accord with the contributions of higher education to our economic growth in accord with the attainment of a greater degree of institutional efficiency it is probably necessary to give heed to the kinds of figures mentioned in this paper. The following kinds of analysis might be appropriate:

(1) Assume that increasing attention is given to projections of manpower requirements. Taking these into account, universities could examine in the light of their follow-up studies whether their students were entering fields of high national priority, and whether they were performing well in those fields. Recognition should be given, of course, to the expectations that might reasonably be held for the types of students that the university was able to attract. That is, the examination should be conducted in "value added" terms, crude though the analysis might have to be.

(2) Using the degree model, together with the follow-up studies, the universities might ask themselves whether they have become unduly wasteful in the consumption of student years. To find that a university appears to require a relatively large amount of student years to produce sets of different kinds of degrees does not in itself mean that the institution is inefficiently managed, though it may. If the excess, relatively speaking, in student years appears to be caused by dropouts, the follow-up studies could reveal whether partial educations are effective in preparing people for important kinds of work. Similarly, the follow-up studies could reveal whether the dropouts return to higher education somewhere and what their subsequent early careers turn out to be. If the excess student years are caused by stretch out, then analysis could indicate whether the longer-term students, given their characteristics, are more or less successful than their counterparts who complete their university work in a shorter time. On the other hand, where excess student years cannot be justified by the post-education experiences of students, then one should examine academic policies: selection, required courses, counseling, to see if the wastage of student time can be reduced.

(3) Taking account of these two analyses, the share of a particular university's purchased inputs in a region might be compared with its shares of outputs, possibly including a weighted value for dropouts. Should a university's products have difficulty in performing well in the nation's economic work, should it be wasteful of student time, and should its share of purchased inputs be rising, then it would seem clear that it should undertake a revision of its programs. As it did so, it would presumably raise the economic productivity of higher education.

These are simple kinds of analyses, but I think they are important. I have seen no evidence that they are now conducted regularly, systematically, and on a university-wide basis. Short of having a comprehensive, well-designed planning model for university operations--and I think this lies some distance in the future--the procedures suggested here could help move us toward more efficient allocation of resources.

Footnotes

1. State Committee on Public Education, Citizens for the 21st Century: Final Report, Sacramento, State Board of Education, 1968, Appendix A, pp. 40-41.

ORGANIZATIONAL EFFECTIVENESS AND INSTITUTIONAL RESEARCH

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Administrators of higher education are becoming increasingly aware of organizational theory as it applies to universities. However, as in most fields, one cannot find many spokesmen for organizational theory, but rather many divergent views are usually represented. One new approach has been to apply social science, specifically social psychology, to the functioning of human organizations. Daniel Katz and Robert L. Kahn in their Social Psychology of Organizations have attempted to do this with a proposed extension of open-system theory, casting it specifically in terms of roles. This paper is an attempt to apply the open-system approach of Katz and Kahn to the process of institutional research in universities. The two major purposes intended for this paper are (1) to suggest ways in which institutional research can contribute to the effectiveness of the university as an organization, and (2) to suggest a functional organizational plan for institutional research, which contributes to this overall objective.

Organizational Theory and the University

According to Katz and Kahn, organizational effectiveness, defined as the maximization of return to the organization by all means, is an inclusive measure of the ongoing state of the organization in relation to its environment. Increases or decreases in organizational effectiveness can be viewed at several levels of abstraction--as transactions between the organization and its own subsystems or individual members, as changes in the pattern of transactions between the organization and the larger environmental system of which it is part.[1]

The university is seen by Katz and Kahn to fulfill two basic functions for the larger social system: (1) maintenance--by inculcating general norms and specific behavioral codes (e.g., educating the citizenry for democracy); (2) adaptive--by generating new insights, developing and testing theories, and applying new information to existing problems. The effectiveness of the university as part of the social system can be determined by the degree to which it contributes to the maximization of these returns to society by all means.

Universities share with other organizations the processes of input, throughput, and output, or in simpler terms: procurement, production, and final products. Furthermore, the development of universities throughout the history of higher education closely parallels the developmental pattern of organizations described by Katz and Kahn. One of the major reservations in applying organizational and systems theory to universities, however, is the lack of defined output. A finished product is necessary to determine the efficiency of the input to the system in terms of the output received. Regardless of this difficulty, there is a discernible demand for the products of the university, i.e., teaching, research, and public service. Any administrator is sharply aware that the functioning of a university requires input of resources--financial, physical, and human--and that the quantity and quality of these inputs depend heavily on the acceptance by society of the products and services received from the university.

The university, then, can be viewed as an organizational unit of a larger social system as well as a system in itself. The university can, hopefully, be

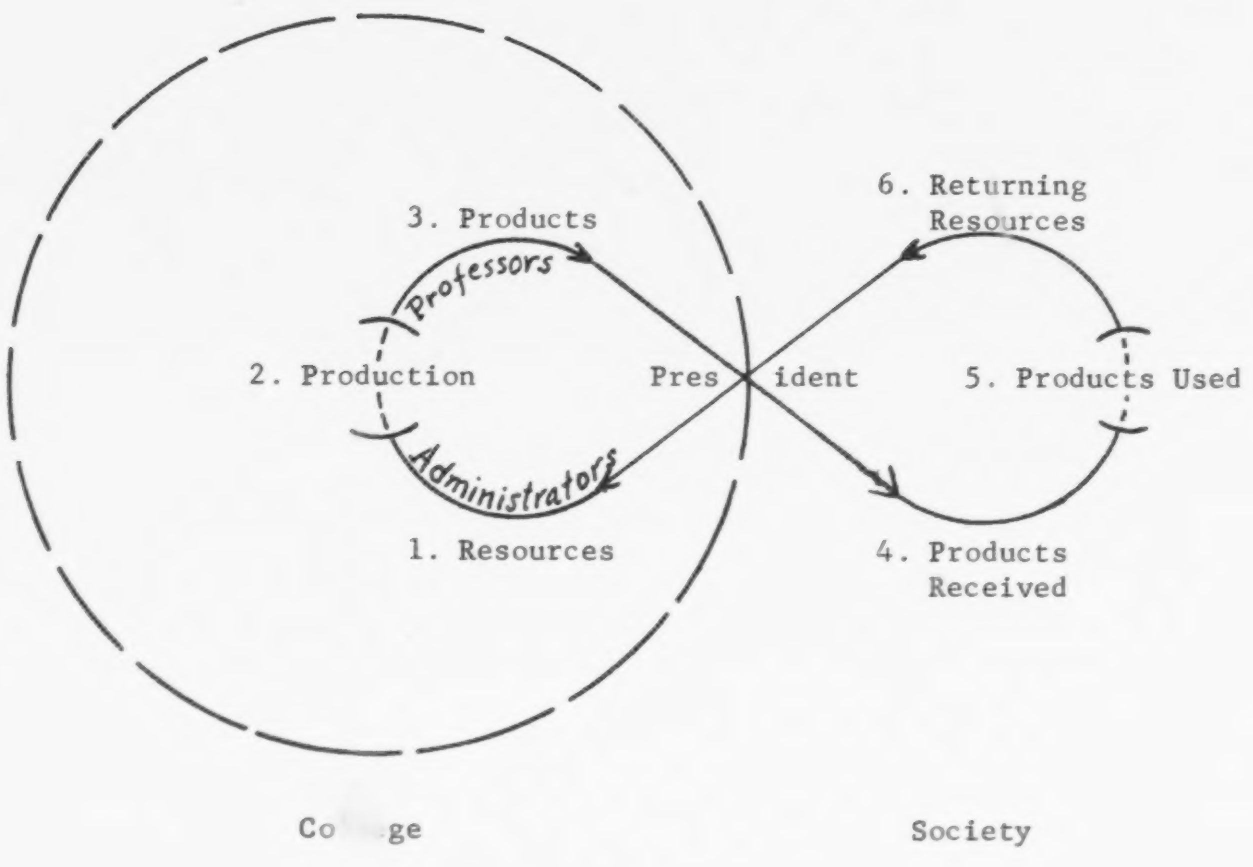
30/31

further identified as an open system, differentiated from a closed system by its desire to seek, receive, and utilize feedback from its environment. The open-system approach to analyzing educational institutions provides a new perspective from which to view the functional parts of the university.

Ross L. Mooney in attempting to conceptualize the relationships of the university to its environment, drawing on general systems theory, has created a model illustrating the flow of resources from the environment to the university and the processes involved in transforming these resources into useful services and products for society.[2] (Figure 1)

Figure 1

Model of a College in Society



According to Mooney, input resources of capital, students, and services reach the university through the president's office. These resources then become the responsibility of the administration which allocates them to instruction and research units. The instruction and research units, primarily the faculty, transform these resources through the instructional and research process into outputs, e.g., educated manpower, new services, technological ideas, for integration into society. The cycle continues with the new resources for input to the university dependent upon the satisfaction of society with the products and services received. This model allows one to see the relationship among all the processes involved, but further analysis is necessary to determine the processes that actually take place within the university.

Within the organization, subsystems are created to assist in the fulfillment of the organizational goals. For a further analysis of the subsystems of the university necessary for its overall purpose we return to Katz and Kahn. The five subsystems described by these authors in their *Social Psychology of Organizations* are (1) production or technical, (2) supportive, (3) maintenance, (4) adaptive, and (5) managerial. For the purposes of this paper only the managerial and adaptive subsystems will be discussed.

Institutional Research as a Regulatory Mechanism

Institutional research as commonly perceived could be considered a regulatory mechanism of the managerial subsystem. Regulatory mechanisms "gather and utilize intelligence about the energic transactions. . .and function to give feedback to the system about its output in relation to its input."[3] The importance of this systematic use of information to guide organizational functions is considered by Katz and Kahn to be the *sine qua non* of an organization.

The studies provided by institutional researchers concerning class size, unit costs, room utilization, length of time for graduation, faculty loads, faculty salaries, program budgeting data, which line the shelves in the offices of most major university administrators today, are outputs, in this context, of the regulatory mechanism of the managerial subsystem. However, one should emphasize that it is the systematic *use* of these studies, not merely the *production* of such reports that is considered the *sine qua non* of an organization. Furthermore, the use these studies receive depends to a large extent on how the data included in these reports have been analyzed, summarized, and applied to the primary function of a university--education. Merely reporting the size of classes or the cost per student credit hour does not demonstrate how the variables of class size, faculty load, instructional technique, and dollar investment affect the efficiency of the learning process--or as a recent publication asked: "When will research improve education?"[4] The following is a major factor being discussed for determining the effectiveness of these operational analyses. The effectiveness of institutional research is dependent upon the degree to which data produced are used in the decision-making processes of the managerial subsystem of a university toward improving the administrative and educational processes. The creation of a functional unit within institutional research offices to provide these analytical studies should probably precede any other function of institutional research.

Institutional Research as an Adaptive Mechanism

In addition to the inward-looking operational analyses already discussed, institutional research can further contribute to the effectiveness of the university by looking outward to the many external communities to which the university is responsible. The second area, then, considered as pertinent to the process of institutional research is the adaptive subsystem. The adaptive function in business and industry can be most readily identified in their research and development groups. These groups project activities into the future and seek to design new products which will be acceptable in a changing environment. Universities, too, are beginning this process as evidenced by the interest and development in long-range planning groups. The 1967 meeting of the Society of College and University Planners considered institutional research to be an integral part of the planning process. By determining and analyzing developing trends in societal needs, institutional research can be instrumental in assisting the university to take adaptive measures to more successfully accomplish its objectives in a changing environment. Such a position should not be interpreted as suggesting that the university must respond to each changing demand society may express. On the other hand, even those philosophers who suggest the university has a basic unchanging purpose for existence still realize that human and financial resources are necessary for continued existence and that the supply of resources is subject to change.

The adaptive concept employs a method of systemic research rather than operational research techniques. The effect of change on one component of the system, e.g., increased use of instructional technology, is seen to have system implications for change on the other components, e.g., faculty, budget, space, etc. Planning for any one of these components without regard for the effect of the change on the remaining components can result in what the organizational theorists call a dysfunctional system.

In implementing this concept of adaptiveness, institutional research should also thoughtfully consider the entire administrative structure itself. New developments in the theory of participative management in human resource accounting, program budgeting, federal support, interinstitutional cooperation, and state planning and coordination may be seen to have direct implication for the administrative structure of universities.[5]

New approaches such as those taken in "University Cities in the Year 2000"[6] and "Educational and Scientific Estate"[7] may alter the role of institutions of higher education thereby necessitating changes in their present organizational forms. Institutional research should contribute to the acquisition of information relevant to the development of new policies and procedures which will be necessary to accommodate such change. Consequently, the organizational effectiveness of institutional research can be determined by the degree to which it looks outward from the university organization toward its external communities to help the university determine developing trends, translate these trends into meaningful management information, and assist it in making organizational changes which will be responsive to the changing external environment.

Organizational Placement of Institutional Research

Now that we have indicated the active role of institutional research in the regulatory and adaptive functions of the university, the second major thesis of the paper can be developed--the organizational framework necessary for the performance of these functions.

The regulatory and adaptive functions represent a view both inward toward the university and outward toward the communities external to the university. The president is one officer in the university who is responsible for implementing both functions. It would seem logical then for institutional research to be organizationally a part of the president's office. In this position institutional research would have a vantage point which relates to the internal academic communities as well as the university's external communities without being obligated to either. An additional consideration favoring such a placement is the importance of institutional research data to the planning process. Even with the advent of planning offices, it is generally agreed that the president of a university is still primary in the planning process. Consequently, if the assumptions stated in this paper are accepted, this placement of institutional research contributes to the university's organizational effectiveness.

The Process of Institutional Research

The activities of institutional research on individual campuses have been largely a product of the individual backgrounds of the respective directors and/or a response to immediate, felt needs of the university. As a result, the term "institutional research" may have as many different connotations as there are institutional researchers. Pleas for direction are heard today from many individuals. Some insist that developmental research is the primary mission of institutional research, some that the instructional process is most important, others that responding to data requests from administration and answering questionnaires is the reason for its existence.

The opposite ends of the continuum concerning the role of institutional research are represented by Nevitt Sanford and John Dale Russell. Sanford suggests that the research leading to improvements in practice will be characterized by "intensive, theoretically-oriented, long-term studies of students and intensive, probably also long-term studies of the inner workings of educational institutions." Institutional research departments should be "free or relatively free of demands from their host institutions for information relevant to their immediate problems."[8] A more pragmatic philosophy is expressed by John Dale Russell in defining institutional research as "an agency. . .attached directly to. . .the office of the president or vice president; it is assigned specific responsibility for carrying on studies needed for the making of important decisions about policy and procedures; and it works toward the primary goal of finding out how to save money that can be used to better advantage."[9]

If a single rationale exists for this paper it is the need to allow both of these functions to coexist in the institutional research process and to consider the addition of a third.

The Organization of Institutional Research

The inward-looking analytical studies necessary for the regulatory function require the creation of what has been referred to as an Analytical Studies Group. The nature of this function requires the involvement of operations research personnel trained in the use of computers to implement the operational analyses.

A second major group in institutional research which may function as either regulatory or adaptive or both is the Developmental Studies Group. Such a group would be more directly involved in the activities described by Sanford and be relatively free from immediate demands of the host institution. It would provide adaptive information through the research of new instructional techniques, curriculum innovations, the impact of a college education, etc.

Each of the two areas above requires trained personnel who can devote their time and effort to continuing projects with a minimum of interruption for immediate answers to pressing problems. Consequently, the third function of institutional research, management information, provides a service which can respond to such requests and at the same time act as an integrative and interpretative agent for the other two areas described.

Institutional researchers have recently been accused of being "unusually ambivalent" about their role in making recommendations and pointing out implications of their studies. Furthermore, the sheer volume of information available to an administrator today necessitates someone performing a filtering task for internal and external information.[10] The management information area, then, would be concerned with sensing relevant changes in the outside world and translating and communicating the meaning of those changes for the university. Information pertinent to the planning or adaptive mechanism of the university contained within analytical studies can be combined with findings from developmental studies and predictions concerning the changing environment to produce relevant management information.

Theory into Practice

In preparing a report on the impact of institutional research on the academic program, Ernest L. Boyer presented two immediate requirements for institutional research if it is to achieve an impact on academic programs. He first suggested that the concept and purposes of institutional research must be sharpened. He further suggested that institutional researchers rearrange their operations so as to create an organizational structure reflecting the variety of responsibility placed upon them.[11] This paper has attempted to use a theoretical, developmental method, to present some possible solutions to the problems which Boyer has perceived. The function of institutional research as described here includes a regulatory function for the university to measure its output in terms of many sources of input, an adaptive function which will assist the university in relating to the changing environment and becoming a more effective societal instrument for change (in some cases requiring suggested changes in the organizational structure itself), and finally a management information group which would be responsible for the interpretation and integration of meaningful management information suitable for current operations and long-range planning.

However, we must not discuss theory to the exclusion of practice. Since many theories are not successful when subjected to empirical testing, it is advantageous for a researcher to have some practical experience in the application of institutional research as well as an interest in theory. Although not all the concepts in this paper have been implemented at Wayne State University, a number have been and many were found to need reworking before application could be considered successful. An additional word of caution should probably be mentioned here. Regardless of the theoretical correctness of an institutional research program, and regardless of the meaningful management information data produced, many decisions in the university are based on politics: the political needs of the state and ways in which additional funds may be derived through state appropriations; the political aspects of the university's environment such as an urban area and the many problems that face the urban society of today (which many people feel should be partially the responsibility of the university); the political structure of academic life itself, the traditional divisiveness between administration and faculty, among disciplines and among the various groups on campus seeking for more power when less power is available for division. These somewhat pessimistic views, though, should not temper or in any way mitigate the efforts of institutional researchers to more clearly define their field. In fact, a clarification of the process of institutional research and its function of service to a university may well lead to the solution of some of the political problem areas here expressed.

In summary, a response to the plea for stated direction for institutional research and an organizational structure which reflects its responsibilities has been attempted. The further development of institutional research depends heavily on the continued efforts of organizational theorists, educational theorists, management theorists, and on the merged views of those engaged in practical applications so that the benefit from each of these fields can be realized in creating, or continuing, an effective institutional research process for institutions of higher education.

Footnotes

1. Daniel Katz and Robert L. Kahn, The Social Psychology of Organizations, John Wiley & Sons, Inc., New York 1966, pp. 458-59.

2. Ross L. Mooney, "Evaluation in Higher Education: Ground, Goal, and a Way to Go," Michigan Association of Colleges and Universities, Proceedings of the 5th Conference, 1967.

3. Katz and Kahn. pp. 43-44.

4. K. Patricia Cross, "When Will Research Improve Education," The Research Reporter, Vol. II, No. 4, The Center for Research and Development in Higher Education, University of California, Berkeley.

5. A complete discussion of Participative Management and Human Resources Accounting is found in Rensis Likert's The Human Organization, McGraw-Hill, New York, 1967. Program Budgeting for Universities and a description of the analytical studies is presented by Harry Williams in Planning for Effective Resource Allocation in Universities, American Council on Education, Washington, D. C., 1966.

6. Stephen R. Graubard, "University Cities in the Year 2000," Daedalus, Summer, 1967, pp. 817-822.

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8. Henry S. Dyer, "Can Institutional Research Lead to a Science of Institutions?" The Educational Record, Fall 1966, pp. 452-466, as cited by K. Patricia Cross, The Research Reporter, Vol. II, No. 4.

9. Paul Wasserman, "The Role of the Information Specialist in Industry," Management Information Systems and the Information Specialist, Krannert Graduate School of Industrial Administration and the University Libraries, Purdue University, 1966.

10. Ernest L. Boyer, "The Impact of Institutional Research on the Academic Program," Albany, New York; Office of University-Wide Activities, State University of New York, 1967, Mimeographed.

SIMULATION: A METHODOLOGY FOR INSTITUTIONAL RESEARCH

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The evolution of program planning and budgeting has created a need to forecast the resource needs of academic programs by type of resource, i.e., people, dollars, and space. A companion problem is given fixed resources to be allocated to programs, how can the allocation be accomplished and still retain the differentiation of resource needs implied by the program budget. There are many other problems equally complex to which instructional researchers must address themselves. The methodologies for studying these issues are many and varied.

The problem solver in this context is faced with a continuum of possible methods of study. At one end of the continuum is the method of experimentation with the real system, while at the other is the method of analytical mathematical solutions. All methods along the continuum, excluding the extremes, are simulation methods which can be partially analytical, analog, and/or "real" schemes for experimentation.

Experimentation with real systems, even though it is done implicitly, necessarily deals with components rather than the entire system and generally has a low payoff in terms of the information gained about relationships between independent and dependent variables. The gain in insight which experimentation brings to decision-makers is important, but it will never yield a very explicit model of the overall process associated with the system.

Analytical mathematical solutions--the other extreme of the continuum--are desired because they allow clear and concise descriptions; and because they are coupled with a system of logic they provide a powerful method for deducing specific conclusions from general symbolic descriptions. Analytical mathematical solutions enable the user to achieve a high degree of rigor, but at the same time they may force the user to limit the scope of his study. Limitation in scope is a definite handicap in the complex university environment. Many times it is impossible to express explicit relationships between independent variables and measures of performance--particularly when there are multiple measures of performance which must be combined into a single "objective function" if optimization is to be achieved.

Simulation, loosely defined, remains as the most flexible study tool to cope with complex problems. The purpose of this paper is to describe simulation methodology, to discuss its strengths and limitations, and to give a simple example of its application.

Simulation Methodology

To employ simulation methodology does not abrogate analytical mathematical methods; rather it is a complement to them. In effect, simulation should be pursued only when the pure analytical pursuit must be abandoned. A lessening of the need for rigor should not be inferred. When using simulation, the researcher performs an experiment using a representation of the system under study, and thus all the requirements for sound experimental design must be followed if useful results are to be obtained.

Building a Simulation Model of a System

The first phase in building a simulation of a system is to identify the relevant components of the system and abstract them--recognizing that not all details of all components can be considered. Levels of abstraction include empirically-related, analog, and symbolic representations.

The key to simulation construction is the identification of the independent variables and dependent variables and their interrelationship. Since much of the process of model making is an art, the researcher must depend on ingenuity and insight into the important aspects of the system under study.

It is important to identify the independent variables that can and cannot be controlled by decision makers. Relationships between independent variables and measures of performance may be established by drawing on theory, when it exists, by using empirical data when observation is possible, or by representing rules or policies governing the activity under study. Where theory, empirical data, or policy are not available, hypothesized relationships may be used as alternatives. Dependent variables should be selected based on their relevance to the decision-making process. The time-worn measures which may be more traditional than rational should be distinguished from those that actually reflect system performance. Even though abandoning less useful performance measures may be difficult, the eventual payoff from having measures more sensitive to system performance will more than offset the problems of abandoning traditional measures.

Planning and Running a Simulation

Since simulation involves experimentation with a model of reality, there must be a method of processing the model and a plan for designing and executing a controlled experiment.

Except for a few types of limited-scope simulation models, the computer is necessary for processing the model. Among other things, the computer provides: (1) fast and accurate processing of the model, (2) the speed and storage capacity which is needed to introduce a large number of independent and dependent variables and to use a variety of ranges for each independent variable, and (3) the capacity to apply the simulation model to human behavior in a realistic manner. In summary, computer capabilities enable the effects of heretofore unencountered conditions to be tested, and the testing can be carried out in a time frame of reference which compresses years into minutes.

Regardless of the capacity of the computer, there is a need for sound experimental design so that the model may be processed efficiently and storage requirements may be kept within bounds. Among other things, an experimental design includes a statement of the objectives of the experiment and plans for controlling certain variables and analyzing the results. An experimental plan is needed to avoid confounding the effects of variables, to minimize the degree of experimental error, and to make efficient use of all the resources required to operate the model.

Before beginning the experiment, validation--to the extent that complete validation is ever possible--should be carried out. In this context, testing for validity is divided into two phases. In the first phase, the internal consistency of the model may be checked by inductive or deductive methods. In the second phase, the model's relationship to the real system may be checked by either using past data to obtain output with which to compare the historical performance of the system or by using current data for predicting the immediate future with which to compare the actual values when they are observable. In the tradition of science, prediction has always been more widely accepted for validation than matching historical performance. The range or tolerance for acceptance of the validity of the model is dependent upon the researcher and the context of the problem.

The execution of the simulation and the evaluation of the results are not easily discussed in general terms because they are oriented to the specific system under study. The experiment is characterized by "running" the model to determine system behavior, to compare the effects among levels of particular variables, or to compare the effects between variables. Where elements of the model are probabilistic in nature and where experimental design principles have been applied, traditional statistical analysis techniques may be used to analyze the results.

Variation in Simulation Techniques

Simulation, as it has been discussed so far, is limited by implication to the type in which a symbolic model (static or dynamic, with or without stochastic elements) is run through a computer. The scope of simulation is much broader than this. Some of the variations in simulation features are the following:

1. Elements of the model may be static or dynamic. When time is a factor, it may be either continuous or discrete.

2. Elements of the model may be deterministic or probabilistic. When probabilistic, data may be used from empirical or theoretical distributions.

3. Human behavior may be included, represented, or excluded. When included, it may take the form of live participation in the experiment. Representation may be accomplished by using a "Monte Carlo" statistical sampling procedure or by using models of policies or action rules controlling human behavior. It should be noted that including live human behavior is not limited to "management games" which have been used for a number of years in industry to involve people in decision-making situations in a training context.

The computer performs many functions beyond that of model processor. Some of these other functions are the following:

1. It generates data using library subroutines for number generation under several distributional doctrines.

2. It serves as the "timekeeper" for processing not only in terms of the total period simulated but also with respect to replications of the run and the interaction of events in a temporal frame of reference.

3. It serves as the "accountant" to tabulate all relevant run data and, when appropriate, to perform statistical analysis of results.

In addition, there are special programming languages such as GPSS[1] and SIMSCRIPT[2] which aid researchers in the fast development and execution of certain types of simulation models.

Capabilities and Limitations of Simulation

Simulation provides a method for studying complex systems heretofore not explorable to any great extent as a system. Simulation provides a method for extending studies to levels which include not only the action of components but also their interaction with other components. Simulation enables behavioral characteristics of a wide range of values for independent variables to be studied in a short period of time. Many interesting contingencies spanning system "years" can be observed in computer "minutes." Simulation allows both transient and steady-state behavior of a system to be observed.

The ability to examine the effects of a number of independent variables on a number of measures of performance is an outstanding feature of simulation. This ability, however, requires that the user sort through the mass of output to extract a clear and concise presentation of the relevant results.

The major limitation of simulation centers on the problem of determining the validity of the model describing the system under study. This is not a unique problem with simulation, but rather, it is a problem plaguing all model-based study methodologies.

An Example Application

A simulation model which is used to forecast and evaluate the need for facilities to house academic programs is described briefly as an example of how the technique can be employed in the continuing study of the problem of determining resource requirements in a program-budgeting context.

Simulation Structure

Included in the structure are the variables and the model components. The variables that are subject to the decision-maker's control are identified specifically. The independent variables included in the model are the following:

1. The student population--the population itself and the load it generates in each academic program are composite variables which have an inherent time dependency.

2. Faculty and other teaching staff--these are not purely independent because they are related by policy to the student, research, and public service loads of academic programs.

3. Support staff--this is not purely independent because it may be related to items 1 and 2 by policy.

4. Space available now and in the future--this composite variable is determined by the present inventory and the space contained in in-process and planned construction less that space which will be lost by razing buildings.

Dependent variables contained in the model are the estimate by program and year of the total space needed and the net space needed, and space utilization.

Space utilization requires some explanation. The projection of all space involves linear equations in which the constants dimensionally represent space per unit. The unit in this case can take the form of student contact hours by type of instruction, full-time equivalents by category, and other relevant activity measures. An ideal module is used for space projection. However, the supply of space is elastic for a given level of demand. For example, classrooms may be planned using a factor of 1.00 net assignable square feet (NASF) per student contact hour (SCH), but the need for classroom space in that program will not be critical until utilization reaches 0.67 NASF/SCH. Thus for each constant in the model there is an ideal value for the module and a minimum value which actually represents maximum or near-maximum utilization.

The overall model is set up in components. The first component handles the population input. This component is semi-independent in that it is a simulation subsystem by itself and can be used for other studies. It is important to note that this component is the key to coordinating the other resources for an academic program. The staff and support money must be developed for the projected student load. The load and staff data then serve as inputs to the model.

The second component transforms the gross population data from all strata into a population of space users. The third component computes the total space, net needs, and utilization measures.

Decision-Makers' Control of Variables

The model provides for decision-makers to control the following items:

1. The size of enrollment by program.

2. The faculty required for a given student load.

3. The types of space available for each strata of the population.

4. The space modules in each strata of the population with respect to each type of space and user.

5. The scheduled use of space related to noninstructional activities.

6. The hours of room use and seat occupancy goals for space related to scheduled instruction.

7. The building projects to satisfy future needs.

8. The removal of space from inventory.

Largely uncontrollable are the overall population seeking an education in an academic program and some of the space requirements for activity units.

Typical Use and Evaluation

As a space estimator and evaluator, the simulation is run with a fixed set of coordinated population estimates which are used with fixed space factors and goals for room and seat occupancy. Room and seat occupancy goals are used only for space related to scheduled instruction.

Runs are made for as many years into the future as there are population forecasts to estimate gross and net space needs by program. Current and future profiles of utilization are calculated for each program and year.

Based on the results of the first runs, building projects and capital budgets are established. Since funding is usually uncertain, maximum and minimum budgets are developed. Buildings to be razed are identified.

Once the decisions about new construction and removal of old buildings are quantified and are entered in the model, the simulation is rerun to determine the effect of the space available on academic programs by year. Other possible construction proposals are tested by using the simulation. Once a proposal is selected for possible implementation, simulation can again be used to conduct a sensitivity analysis. Sensitivity analysis allows the stability of the solution to be tested against the contingency of drastic changes in those factors which are most subject to change, such as the student population and the load it generates. The model may also be used to calculate the reductions in capacity that may be necessary if no new space is added.

Summary and Concluding Remarks

In the context of sound experimental design, it can be said that simulation is a powerful tool, limited only by a researcher's ability to make valid abstractions and by his ability to use these abstractions in conjunction with available computational tools.

Simulation is not a static technique, but rather it grows in its potential application because there is heuristic development in the sense that what is learned about a system may increase the researcher's ability to abstract it and because faster computers with ever increasing storage capacity and easily used languages make the processing of models faster and more efficient.

Simulation as a method for operations analysis was born in a military environment. Its first nonmilitary application was to the area of industrial operations analysis problems. Success was immediate and is continuing. Now the application is to the university environment. The applications to date have barely scratched the surface of the problems needing attention. With the power and flexibility of the technique, there is a great future for it in institutional research.

Footnotes

1. General Purpose System Simulation II, Reference Manual, IBM Corp., 1966.

2. Simscript Compiler Program, Share Distribution Center, White Plains, New York.

ESTABLISHING NEW UNIVERSITIES: IMPLEMENTATION OF A STATE MASTER PLAN

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Approximately forty states now have coordinating agencies that engage, either informally or formally and by mandate, in master planning for the state-wide coordination and development of higher education. In this context, how may statewide master planning be defined? Typical of most formal definitions is the one in the charge to a panel of consultants to the Florida State Board of Regents, which was to initiate "continuing studies basic to the development of a system of higher education in the State which will provide the highest quality programs for the greatest number of people at the lowest possible cost."[1] Quality, quantity, and economy are the three simultaneous goals usually embodied in the legal charge to the coordinating agency. Needless to say, these somewhat inconsistent goals are not reached simultaneously; and practice often falls far short of such lofty ideals.

This report describes how the Board of Higher Education of the State of Illinois discharges one aspect of its general responsibilities for master planning; namely, in the establishment of new institutions of higher education. The particular case of two new senior universities currently being established is used as an illustrative example.

The new senior institutions were recommended in the second phase of the Illinois Master Plan for Higher Education. As a frame of reference, Phase I had established the state junior college system and its governing board; Phase II had revamped the governing boards for senior institutions and recommended new universities; Phase III, currently being launched, deals with graduate and professional education. Subsequent phases will deal with continuing and adult education and community services, nondegree occupational programs, and others.

As a direct result of Phase II Master Plan recommendations, the Illinois General Assembly passed Senate Bill 955 which Governor Kerner signed into law on July 14, 1967. This bill appropriated three million dollars for campus planning for two new universities, site acquisition, and architectural services--the funds to be allocated to the appropriate governing boards by the Governor upon the recommendation of the Board of Higher Education. Phase II planning studies had shown that the highest priorities of need for new senior institutions were in Springfield, one of the few state capitals in the union without a public senior institution, and in the six-county Chicago Metropolitan Statistical Area.

Because of the gravity of the problems associated with the assignment of governance and planning for these new institutions, the Board in an unprecedented move established a special committee of seven Board members to work with the staff to "make recommendations to the Board on the function, the general location, and the initial governance of the two senior institutions."

The Special Committee utilized two approaches to these problems: one was a series of meetings, public hearings, and the convening of special advisory committees; the other was an extensive series of staff studies and research reports.

The staff studies dealt with the diversity of higher educational needs in the two areas: the functions, programs, and level of instruction best fitted to meet these needs; approximate site locations; and the most appropriate governing board based on similarity between the new university and the type of institutions already under each board. The background studies paid special attention to such factors as articulation with feeder institutions (especially public junior colleges), avoidance of duplication and competition with other senior institutions, transportation patterns for the predominantly commuter student body, enrollment projections, availability of land, and specific area needs for college-trained personnel. Particular consideration was given to higher education needs of the large number of disadvantaged youth in the city of Chicago.

An Example: Studies on Site Location

The complete set of studies are too numerous and diverse to describe fully in this report; hence, only one subset will be discussed as an illustrative example. (A complete report has been published by the Board and is available upon request.[2]) This subset of studies dealt with the question: Where in the six-county Chicago Metropolitan Statistical Area should the new institution be located? Clearly this question was interrelated with preconditions such as the following:

1. What were the diverse higher education needs in this area? After careful and extensive study, these needs were described in such terms as "increased production of high-level scientific research personnel," "broadened educational opportunity for severely disadvantaged youth in the inner city," and "residence and extension-type programs to retain and upgrade present skills and to inculcate new skills for nearly all types of occupations and professions." The needs were many and critical. Careful consideration of their priority indicated that the new university should serve the burgeoning number of general college students in this area. Projections showed that by the year 2010 over 12,000,000 persons, nearly double the 1960 population, will reside in the area. Immediately after 1970, this mushrooming population will include about one-half million young persons of college age (18-22). The number of youth graduating from high school yearly is expected to increase 72 percent from 84,000 in 1966-67 to approximately 145,000 in 1979-80. This unprecedented increase, along with a rising college attendance rate, will not only double the flow of students into junior colleges but also swell the pressure on upper division and graduate programs.

2. What functional emphasis of the proposed institution would best serve these needs? Given the rapid growth of public junior colleges in the area and their tendency to serve increasingly large segments of the freshman-sophomore age cohort, the decision was made to give top priority to an institution which would serve their graduates and transfers. Studies were conducted of the career orientations of such students; the results showed that these students included a large and increasing proportion of those who tend toward the subprofessional "middle-management" and technician occupations. The area-need studies mentioned above had identified precisely these types of occupations which are likely to experience acute manpower shortages during the next ten to twenty years. A severe shortage of systems analysts and computer programmers already

exists, and this problem will likely become even more critical during the next ten years. For example, there were 40,000 computer programmers employed in business, industry, and government in 1960; it was estimated that 200,000 to 300,000 will be needed by 1970.[3] It seems clear that in this metropolitan area, future skill needs will increasingly focus on college level training and beyond. Hence, these findings called for a functional emphasis which would funnel the growing stockpile of career aspirations into the matching area needs.

3. What programs would best carry out these functions? After considerable study higher education curriculum specialists indicated that, as a necessary first condition, the institution should have a strong core of liberal arts and science courses. The types of careers or occupations for which the university might develop specific programs are teachers for the public schools, social workers, urban planning specialists, librarians, business and public administrators, institutional managers, systems analysts, data and information processing specialists, applied scientists and laboratory technicians, nurses and allied health professionals, and similar occupations of critical importance to the urban community. These curricula should be available to employed persons for mid-career training as well as to regular college students. In addition, the university should provide a high level of educational community services, including cultural activities and cooperative programs with school districts, business, industry, and governmental agencies, and faculty services in consultative and research capacities with all interested community groups.

4. What levels of instruction should be offered? Given the needs, functions and programs described above, and the burgeoning public junior colleges in the area, it was recommended that the new institution offer programs at the junior-year level extending to, and including, the master's degree. Such an institution would be a "capstone" for junior college programs. It was further specified that any needed remedial work involving course work below this level should be offered in junior colleges or other available institutions, perhaps through dual enrollment. Thus, the institution would not duplicate junior college programs and would be minimally competitive with nonpublic senior institutions.

5. Should it be a resident or commuter campus? In line with other Master Plan provisions urging that the state expend its limited funds to broaden higher educational opportunity to as many Illinois youth as possible, it was recommended that the new university be designed primarily to serve commuter needs.

It was only after a decision had been reached on all of these and other basic considerations that attention was turned to the question of where the new university should be located. Important factors related to this question were studied in a more or less logical sequence through a variety of approaches.

A fundamental determination in proposing the location was to weigh the merits of a placement within the city of Chicago as contrasted with the suburbs. Availability of current educational opportunities tended to rule out a city location.

The city, a small area as compared with the remainder of the six-county area, already had excellent commuting opportunities in thirty-one senior institutions, three of which were publicly supported.

The question of propinquity to the city was determined by a special demographic study which showed that while the rate of growth in population density was much more rapid in the suburbs, the present density of population in the city is about fifteen times greater than in the rest of the area. It was apparent, therefore, that any location in a suburban area should be close to the city of Chicago to serve, in part, the heavy concentration of city population. Specifically, the location should be within Cook County, of which the city comprises the central one-third in area.

The question then became one of north or north-central Cook County versus the south or south-central section. Careful study of the important interrelated factors resulted in seven factors which pointed toward the primacy of need for a public senior institution in southern Cook County proximate to the south perimeter of the city:

1. Availability of senior institutions--Within the southern half of Cook County (outside of Chicago) there is only one senior institution, a theological seminary which enrolled 72 students during the academic year 1967-68. Further the only senior institution in the southern one-third of the city of Chicago is a four-year denominational women's college. In sharp contrast, the northern half of Cook County outside of Chicago contains ten senior institutions with a combined Fall, 1967, enrollment of over 22,000. Of these, about one-third were commuting students.

2. Proximity to junior colleges--Present and projected statistics indicated that more students were enrolled in junior colleges in the southern half of Cook County than in the northern half--20,097 versus 31,144, respectively, projected for 1972.

3. Accommodation of high school graduates--There is a very large population base of projected 1980 high school graduates in southern Cook County and the southernmost third of Chicago presently without provision for public senior institutions to which they might commute. (Data provided by the Bureau of Institutional Research, University of Illinois.) The southern half of Cook County is projected to have about 26,000 high school graduates in 1980 compared with 25,000 for the northern half. The entire southern half of Cook County and the southernmost third of the city of Chicago contain only two private noncoeducational senior colleges serving a population of more than one million persons. The research staff uncovered no other area in the United States with so large a concentration of population which has no provision whatever for publicly supported upper division and graduate education.

4. Availability of land--An intensive aerial survey of the entire six-county metropolitan area conducted in 1964 by the Northeastern Illinois Planning Commission revealed that southern Cook County, unlike the suburban areas adjacent to the western and northern city limits, contains many tracts of agricultural and vacant land among the fast-growing suburban communities. This survey also showed many

large commercial and industrial complexes in and near the southernmost perimeter of Chicago and the adjoining suburbs.

5. Need for trained personnel--The many governmental agencies as well as commercial and business establishments in southern Cook County need the trained personnel to be produced by the proposed new institution. Conversely, it can be safely assumed that these vital enterprises will provide many locally available employment opportunities for students and qualified graduates of an occupationally oriented institution, just as similar enterprises in northern and western Cook County welcome graduates of the many senior institutions now present in their vicinity. For example, a special survey conducted by the office of the Cook County Superintendent of Schools revealed that "before the commencement of the 1967-68 school year. . . there were approximately 500 teaching vacancies on the elementary and secondary levels. Of these 500, two-thirds of the teaching vacancies were located in the southwest and south sections of Cook County. The western and northern parts of the county were experiencing less difficulty in allocating teacher candidates to fill these positions. It would seem logical to assume that if a senior college were located in the south or southwest, it would greatly reduce the teacher shortage in Cook County. We are assuming here that many of the graduates would remain in the immediate area to locate a teaching position."[4]

6. Need to step up college attendance rates--Evidence accumulated through special surveys and interviews indicated that at the present time the college attendance rate is significantly lower in southern Cook County than in the northern portion. The college-going rate in the fourteen high school districts located within or adjacent to the area ultimately selected was, in aggregate, 53 percent for June, 1967, graduates. This is in sharp contrast with the northern and northwestern portions of Cook County. For example, in a paper presented to the Board on behalf of six populous townships in northwestern Cook County it was revealed that the college-going rate was "in 1950 barely 50 percent" and "in 1965 this percentage has risen to 76 percent." Moreover, "school authorities there expect this percentage to rise even higher as additional higher educational facilities are available and as diversified programs are offered."

7. Service to lower socio-economic groups--Socio-economic characteristics of southern Cook County indicated a greater need for the new senior institution than in the northern or northwestern portions of Cook County. The decision to begin and to continue in college is largely determined not only by academic qualifications but also by economic and social factors of the family and community. "Previous studies of the (Northeastern Illinois) Planning Commission show that the socio-economic characteristics of the population tend to be highest in the north shore suburbs and to descend in a fairly systematic manner, as one moves in an arc to the northwest, the west, the southwest, and the southern part of the suburbs."[5]

All of these, and other factors as well, helped the Special Committee to determine that the general location of the new university should be within a ten mile square located at the center of an area comprised of the southern half of Cook County and the southernmost third of the city of Chicago.

The Dialectic Approach

Concurrent with the studies described above, the Board through its Special Committee employed a dialectic approach which emphasized hearings and meetings of spokesmen for Illinois higher education, legislative leaders, and private citizens.

The Special Committee itself met nine times during which it reviewed all pertinent staff documents and gave direction and specific requests for staff studies. Two public hearings were held for the presentations of spokesmen for the various systems of public higher education, nonpublic institutions, community and civic groups, interested organizations, and others who desired an audience in respect to this matter.

In addition, the Special Committee called upon the three standing advisory committees of the Board to deal specifically with the assignment of governance of the two new universities. These committees are: (a) the 17-person Citizens Advisory Committee, comprised of leading citizens from many walks of life in all sections of the state; (b) the 27-person Faculty Advisory Committee, comprised of faculty members from all public senior institutions in Illinois and many representative private institutions; and (c) the 21-person Presidents Advisory Committee, comprised of all presidents of Illinois public senior institutions and representative private colleges and universities.

After consideration of the role and function of the new Chicago university and the type of institutions grouped under the various governing boards, governance was assigned to the Board of Governors of State Colleges and Universities, which already operated two freestanding universities in the area. The Springfield university was assigned to the Board of Regents, which governs Illinois State University at Bloomington and Northern Illinois University at DeKalb. The Governor in March, 1968, released the appropriations to the governing boards for planning purposes and site acquisition.

The functions and powers of the Board of Higher Education, as expressed in its enabling legislation, and the wide sphere of advice and consultation employed by the Special Committee enabled the Board also to deal with many important and closely related policy questions. For instance, the Board recommended the following: "The large number and variety of students anticipated in the Chicago Metropolitan Area point to the need for establishing several more public senior higher institutions in Illinois in future years, particular[illegible] the Chicago area; and continuing studies should be made of these needs. Fo[illegible]le, the development of the world's largest atomic accelerator at Weston [illegible]e vast Argonne National Laboratory creates the ideal opportunity for Il[illegible] to develop an unparalleled scientific institution in the near future."

The Board also dealt with the important question of appropriate institutional arrangements for the new institutions by recommending that each of the universities is to be a free-standing institution from its inception, not a branch campus of a parent university.

Overview

This report has described the research and dialectic processes involved in the creation of two new senior universities by the Illinois Board of Higher Education. It has placed this activity in the setting of state-wide coordination of higher education, that is, as an element of a developing overall master plan for the state.

The establishment of new universities is properly part of the developmental process that comprehends the complex interrelationship of all segments of the higher education enterprise--public and private, present and future--from junior college through graduate school. For example, creation of new institutions changes the relative fiscal, political, and educational weight of each of the various systems of higher education in the state. Because vested educational interests are directly affected, decisions such as the assignment of governance to any particular system are best made by an agency with purview which comprehends all systems, such as a state-wide coordinating board.

The orderly procedure described in this paper requires governing boards to submit their cases to an impartial board with a state-wide purview which conducts its own independent research, hearings, and meetings. This is in sharp contrast to the more commonly used procedures of unilateral maneuvering and appeals to influential alumni for support and to politicians for "pork barrel" budget allocations. In such cases the drive by an institution or governing board for a branch campus or new institution is based primarily, not on appropriateness of role or function, but on the desire to protect or expand the share of legislative appropriations tied to enrollment increases. The result too often is educational gerrymandering exemplified by a land-grant university with an agricultural and basic research orientation attempting to replicate its pastoral campus in the middle of a metropolis, or by commuter campuses located not for accessibility, but in response to pressure from a powerful legislator.

This is not to imply that the nascent coordinating agencies have somehow perfected educational decision-making. Far from it--they make mistakes and will continue to do so largely because they are pioneering in an extremely complex and difficult endeavor. It seems clear, however, that they have already succeeded in bringing some order out of chaos. To the extent that this order is almost universally desirable, they have been praised for their accomplishments. However, judgment upon what they will do with the new order will be much more harsh because there will be no consensus of approval for whatever decisions must then be made.

Historically, the emerging concepts of state-wide planning are unprecedented in a country which has seen virtually every institution of higher education established without regard to articulation with others offering similar or complementary functions. As nearly all of the coordinating agencies expand their staffs to include research personnel, master planning is increasingly based on "in-shop" research studies and related activities. At present, however, the capacities and capabilities of the research staffs lag behind the increasing research needs. This gap derives not only from understaffing, underbudgeting and a critical lack of adequately trained personnel, but also to a nearly total absence of pertinent theoretical models and precedents. Thus, critical coordinating decisions are made largely without reference to useful theoretical models, but are based instead on available empirical evidence applied specifically to practical and immediate problems. This observation is by no means an apology for this happens (for better or worse) to be the way the real world necessarily operates. We shall continue to look to university-based researchers for useful theoretical models. Until such time as they are available, however, coordinating agency research activities shall mirror and undergird the pragmatic, dialectial, and political processes described here.

Footnotes

1. J. B. Culpepper and G. Emerson Tully, Antecedents to Master Planning for Higher Education in Florida, Florida Board of Regents, Staff Study Report No. 101, October, 1967.

2. Lyman A. Glenny, Arthur D. Browne, and Robert H. Fenske, Report on New Senior Institutions, The Illinois Board of Higher Education, Springfield, Illinois, February, 1968.

3. Corplan Associates, Summary, Illinois Institute of Technology, 1964.

4. Correspondence to the Board of Higher Education from the Cook County Superintendent of Schools, October 27, 1967.

5. Northeastern Illinois Planning Commission, Population and Housing, April, 1965, p. 71.

RATIONALE FOR USING MICRO-ANALYTIC APPROACHES IN PREDICTING THE CHARACTER AND SIZE OF COLLEGE STUDENT ENROLLMENTS

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The chief aim of this paper is to propose the use of micro-analytic research approaches, focused on factors contributing to the college enrollment decisions of individual students, as a complement to conventional macro-level approaches to enrollment prediction. A method for simulating enrollment choice behavior which offers possibilities for micro-level studies is also described.

The ideas presented in this paper were developed in the course of a search for systems models that would be useful for analyzing the effects of changes in college student selection and retention policies on the size and character of student enrollments. Major emphasis was given at first to the development of macro-level models for analyzing the flow of defined groups of students into and through specified educational channels and for estimating via simulation procedures the possible effects of changes in requirements regulating admission and continuance on the characteristics of the student body as well as on their overall numbers. While this exploration of macro-level approaches was not without rewards, it left unsatisfied many questions about the nature of the relationships between student enrollment choices and the options that they perceived to be available to them--questions which suggested that the entire field of enrollment prediction would be enriched by intensive studies of the individual enrollment decision process.

Attractive as the possibilities of micro-level approaches thus seemed to be, they do involve numerous and difficult problems of study strategy and design. These problems are particularly awesome if one wishes to conceive the study of enrollment behavior within a systems framework, such that findings on many specific relationships may be eventually integrated into a total enrollment behavior system. The authors were, therefore, very much interested when they found that a micro-analytic methodology that had been devised by a team of economists as a general tool for broad investigations of the aspects of the U. S. socio-economic system offered possibilities for enrollment behavior study.[1] Although experience with the application of this micro approach to enrollment prediction is limited, the authors believe that the methodology may be of interest to other researchers.

Contrasting Nature of Enrollment Behavior as Conceived at Macro- and Micro-levels of Study

Many, perhaps most, studies concerned with enrollment prediction aim at estimating the numbers of students that can be expected to enroll in various levels and types of education at specified future dates. These estimates may be made solely in terms of proportions of defined population groups without reference to the previous educational status of the students. The characteristic study, however, considers the flow of students from one educational level to the next and is concerned with estimating the proportions of given student groups that are likely to make the move or transition from one stage to another. These studies thus take a macro-level view of the enrollment flow of student aggregates.

This macro-level view may be contrasted with a second conception of enrollments as the resultant of a series of choices on the part of many individual students. The individual choices--to enroll or not to enroll; to enroll in program A in College B rather than program A in College C; to continue to enroll in subsequent years, etc.--constitute the domain of micro-level enrollment behaviors. The factors that are potentially or actually relevant to these enrollment decisions, whether they lie in the individual student's background or in the educational program alternatives open to him, constitute the various domains of independent variables to be investigated in micro-level studies.

The differences in macro- and micro-level conceptions of enrollment study are epitomized by the contrast between the term student flow, which is frequently used in conjunction with macro-level studies, and the terms student movement or student enrollment behavior, which seem more appropriate to micro-level studies. The term student flow suggests a conception of enrollments as analogous to a liquid mass, flowing through a course, regulated by gates of various heights. The student population under investigation is assumed to be homogeneous in character and consistent in enrollment decision processes. The terms student movement or enrollment behavior, on the other hand, suggest a more dynamic conception of enrollment choices, involving many different forms of decisions, including changes in course and interruptions of enrollment. The focus of attention for the macro approach is on the prediction of general trends in college enrollment patterns without attention to the underlying considerations that are the prime concern of the micro approach.

Another way of expressing this difference in perspective of the two approaches is that the macro-level view looks at the educational system from the outside while the micro-level view gets inside the system. As Richard Stone pointed out at the 1967 OECD Conference on the Use of Mathematical Models in Education, conventional approaches to the study of student flow through educational systems usually divide the educational system up into branches but do not try to get inside the branches and see what is going on within.[2] (Stone recommended that psychologists and educators be encouraged to join economists and systems analysts in the study of educational systems because of their presumed greater interest in what goes on inside the system.)

What goes on inside an educational system is partly a matter of differences in individual behavior, including the student enrollment behavior differences referred to above, but also a matter of variations in educational arrangements, including changes in the educational choices available to students. Although there is an intrinsic relationship between the micro-level approach and the focus on individual differences in behavior, the second category of variations within the system--variation in educational program alternatives--can be appropriately analyzed in terms of effects on aggregate enrollments as well as differential effects on various types of students. This source of variation can thus be studied at both macro- and micro-levels but for different purposes. It was in fact the authors' experience in using macro-level approaches for a study concerned with the effects of changes in educational program alternatives that led to the consideration of the differences in the nature of the two levels of enrollment behavior analyses reported in this paper.

The problem was typical of many that arise within complex universities or other interrelated systems of educational institutions in which component colleges establish independently their own requirements for student selection and retention. Because this problem posed some interesting questions with respect to possible enrollment consequences both for the college proposing the changes and for other colleges likely to be affected by the changes, it afforded a good opportunity to explore methods for predicting the enrollment effects of such policy changes via simulation procedures.

The change under study involved several revisions in the requirements for admission to the upper division of the liberal arts college of a large university. These revisions embodied, among other points, a considerable strengthening of the foreign language requirement. The curricular rationale for this proposal was sound in terms of the college program objectives and was not under study. The question of interest concerned the effects of the proposed change in admission requirements, not only on the number of students likely to be enrolled, but also on the sex and ability distribution of the group that would be selected for the upper division program. Other variables of interest were the high school background of the student, particularly as this might be related to the opportunity for foreign language study, and family background. One circumstantial consideration of significance was that alternative upper division majors related to most of the liberal arts fields were available in other colleges of the university, in particular in the College of Education, the Institute of Technology and the School of Business Administration.

It seemed natural to begin the study by examining the existing student enrollment flow patterns for students within the liberal arts college using a macro-level approach. Proportions of students admitted to the upper division program and continuing in it to graduation were the variables investigated. In order to consider the questions as to effects of the new requirements on the characteristics of the student enrollment, e.g., on the proportion of male students that would be enrolled, it was, of course, necessary to investigate the enrollment trends for subcategories of students. Separate enrollment trend models were thus developed for student groups distinguished by sex and ability level--a total of approximately fifty such groups being considered.

The experience of developing these enrollment trend patterns was instructive in many respects, not least of all in demonstrating forcefully the problems of data gaps and other inadequacies which plague detailed studies of enrollments, but most relevant to this discussion was the finding that the macro approach was not sufficiently flexible for the simultaneous investigation of more than a very limited number of variables. It was particularly difficult to extend or alter the list of variables to be examined once the model plan has been developed. It was at this point that it became clear that the unit of enrollment behavior that was of primary interest for the problem under study was the individual student's choice among alternatives. The investigators thus turned to examining the possibilities for micro-level analysis.

A Micro-analytic Model for Simulation Studies

The search for appropriate models and analytic procedures led us to a model that had been designed by a group of economists and computer specialists for studies of various aspects of the United States socio-economic system.[3] These investigators were concerned with the general problem of how to predict the effects of policy decisions on the behavior of various aspects of this system. They concluded that the reliability of such predictions might be improved if they were generated by a model constructed in terms of the behavior and interactions of the fundamental units of the socio-economic system.

The reasoning that led this group to develop their proposal for a micro-analytic approach to the study of such matters as the participation of individuals in the labor force or the projection of family characteristics of the population paralleled in many ways the conclusions as to the appropriate strategy for predicting enrollment behavior that the authors of this paper had reached. In particular, Orcutt and his associates questioned the value of continued reliance on macro-level economic studies, based on highly aggregatized time series of income and employment data, for the study of economic behavior. In their opinion, such approaches can be useful only for analyzing relatively simple relationships involving highly homogeneous responses. Such aggregation procedures obscured understanding of the more complex aspects of economic behavior. They therefore argued for the use of micro-level analytic models whereby predictions might be made on the basis of knowledge about the elementary decision-making units of the economy, that is individuals, households, and firms. They wanted to examine how these units behaved, how they responded to changes in their situations, and how they interacted with one another.

It was of particular interest that one of the applications suggested for this micro-analytic approach was the study of college enrollment predictions, a recommendation made by Alice Rivlin, one of the economists who participated in the model development project.[4] Subsequently, Moser and Redfern suggested that the Orcutt "micro" model might be useful as an alternative to the macro-level model that they proposed for the educational system of England and Wales.[5] As special advantages of the micro approach, Moser and Redfern noted its openness to the consideration of questions not foreseen in the original model design.

The key feature of micro models is the focus on the behavior of the decision-making unit. In studies of the type contemplated in this paper, the problems of handling sizable amounts of data, with the individual as the study unit, can be formidable. A significant aspect of the Orcutt study is, therefore, its development and exposition of a computer procedure for simulating the behavior under investigation in any particular application of the model, e.g., changes in the U. S. labor force over a given time period.

As applied to the study of enrollment behavior, the development of a micro-analytic model would mean the gradual building of an integrated system of hypotheses about the enrollment decisions of individuals. Such a model could then be used to predict various aspects of the enrollment characteristics of the educational institutions embodied in the system. The construction of such a model is seen as a major enterprise in which many investigations would be drawn upon for information. Individual researchers will wish to focus on various combinations of variables, but the procedure proposed by Orcutt provides means for integrating such separate studies on a "building block" basis.

Method of Simulating Enrollment Histories

The basic data resources for the micro-analytic model are sets of synthetic enrollment histories developed on the basis of hypothesized behavioral relationships and recorded on magnetic tapes. A brief description of the procedure whereby these histories could be generated may be helpful in clarifying the simulation method.

Step 1. Selection of a sample of individuals representative of the reference population for the inquiry.

Step 2. Collection of data on background characteristics for each individual in the sample and recording of these data in coded form on a magnetic tape. (These characteristics might include such matters as sex, age, academic ability measures, achievement record, high school attendance, family background data, interest measures, and so on, which are judged to be potentially, if not immediately, relevant to the study.)

Step 3. Generation of a simulated enrollment history for each individual via a series of computer runs, each run corresponding to one quarter, one semester, one academic year, or whatever time period is judged to be appropriate.

(a) Each stage of this enrollment history generation procedure consists of applying one or more hypotheses about the relationship between individual student characteristics and probabilities of enrollments such as might be derived from existing evidence or as might be postulated under some logical principle.

(b) The probability of enrollment is calculated separately for each sample case in turn (e.g., case 095, with the characteristics male, high school rank in the top decile, ability score in the top decile, who was enrolled in the last quarter of the sophomore year, may be found to have a probability of enrollment in the first quarter of the junior year in College X of .70.)

(c) A Monte Carlo procedure is used to determine whether or not each individual case will be recorded as enrolled or not. (i.e., A random number is drawn by the computer at the same time as the enrollment probability is computed for each case. If the random number is equal or less than the computed probability, a code designating enrollment is recorded on the taped history for that case.)

The result of this computer procedure is a series of synthetic enrollment histories for the designated sample developed in accordance with whatever relationships between individual characteristics and enrollment possibilities were hypothesized. Such enrollment histories may sometimes be of immediate use, particularly in those instances where the enrollment behavior relationships hypothesized have already been fairly well established and the purpose of the simulation study is to apply these relationships to new samples or situations. In most instances, however, it is likely that the simulated histories would be used primarily as a basis for identifying inadequacies in the enrollment behavior relationships as presently understood and thus serving to stimulate further investigation.

The identification of such inadequacies suggests an important link between the micro- and macro-level studies since important checks on the micro-analytic process lie in the extent to which the numbers of key groups of students, projected for various enrollment periods via the micro procedure, match with known data.

Checks on the adequacy on the internal relationships of the data will require comparisons with sample enrollment histories as well--something now often difficult to obtain. Indeed an important use of the synthesized enrollment history data could eventually be as a substitute for the collection of such individual data on other than a sampling basis. Perhaps even more important, possibilities for experimental use of the model should become feasible as the synthesized behavioral network linking individual student characteristics with various enrollment alternatives becomes increasingly well established. If this can be achieved then, the model would indeed provide a useful basis for simulating enrollment behavior under varying educational circumstances.

Evaluation of Macro- and Micro-Level Approaches for the Study of Enrollment Behavior

We have yet to put the micro model to test, so what we may say with respect to evaluation must be based on judgments of a macro-level approach, with which we have some experience, but for which we see limitations for our study purposes, as compared with micro-level approaches in which we see possibilities although also many difficulties in execution.

Two points are considered in this appraisal: first, the relevance of the two types of models to the study of enrollment behavior; and then, the feasibility of developing models of the two types. Beginning first with the basic question as to the relation of the two models to the behavior that one wishes to study, it seems clear to us that the full study of enrollments will require investigation, preferably integrated, at both the macro- and micro-levels. Macro-level models can provide a valuable base for enrollment prediction, particularly under stable circumstances, but they need to be supplemented by experimental investigations in which the interaction of individual and situational variables in enrollment decisions can be explored.

As matters now stand, we have no firm assurance that the nature of enrollment behavior, as it relates to the variables available to us now for analysis, is sufficiently regular that a detailed behavioral network can be developed. The part that changes in educational alternatives play in determining such behavior appears to be very little explored as yet. But there is evidence of sufficient regularities in enrollment patterns, especially with respect to initial college choices, to encourage systematic inquiry. It was indeed the regularities that could be observed in the studies of college attendance, such as have been reported for the state of Minnesota by Berdie and Hood,[6] that encouraged the authors to consider the use of systems models as a basis for understanding enrollment behavior. So, although there is certainly a risk that the attempt to develop micro-analytic models may prove to be unwarranted by the present state of knowledge, we are inclined to think that it is worth a trial. One consequence could be the encouragement of coordinated activity on the part of various researchers.

With respect to feasibility of model development at the present date of knowledge of enrollment behavior and given the present data resources for most studies, macro-level approaches seem to offer the best possibilities for the production of immediately useful information in most situations. There are also important advantages in the analytic efficiency of macro models because of the feasibility of applying matrix methods to the solution of many enrollment prediction problems using such models. While some micro-level models may also be amenable to analytic solutions, the relationship patterns that are likely to develop may often be too complex to permit feasible analytic solutions. This was in fact the situation that led to the proposal of a simulation procedure for the micro-analytic model proposed by Orcutt and his colleagues.

Gaps in the available data based on student enrollment are a serious problem to all studies in this area, at either macro- or micro-levels. It is likely, though, that the improvements with respect to data resources that can be anticipated in the near future, because of the nature of the public demand for enrollment information, are more likely to provide the data on group enrollments most usable for macro models. Development of more detailed individual student history data and of data on relationships between educational program developments and the enrollments of various heights of students will require more specialized data collection programs and detailed analytic studies. One argument for the initiation of micro-level studies would be to stimulate the development of such data resources, but because of the high costs involved one cannot be too optimistic as to the possibilities for such developments in the near future.

What then are our conclusions? The general research strategy that we recommend, and that we hope to follow in our own studies, is to continue investigations at the macro level, using models of this type to develop understandings of the overall trends in college enrollments in various student groups, but also to direct at least some effort to testing the possibilities of micro-level studies, including the development of synthetic enrollment history records. We would hope that such a dual approach would pay off in providing a much richer understanding of the dynamics of enrollment behavior as well as in providing a more satisfactory means for predicting the enrollment consequences of decisions affecting the educational options available to students.

Footnotes

1. Guy Orcutt and others, Micro-analysis of Socio-Economic Systems--a Simulation Study. New York: Harper and Row, 1960.

2. Richard Stone, "A View of the Conference." In OECD Education and Development Technical Reports, Mathematical Models in Educational Planning. Paris: Organization for Economic Cooperation and Development, 1967. pp. 7-20.

3. Orcutt, op. cit.

4. Alice Rivlin, "The Demand for Higher Education." In Guy Orcutt and others, op. cit., pp. 257-281.

5. C. A. Moser and P. Redfern, "Education and Manpower: Some Current Research." In C. M. Berners-Lee (Ed.), Models for Decision. London: English Universities Press, 1965. pp. 71-83.

6. Ralph F. Berdie and Albert B. Hood, Decision for Tomorrow: Plans of High School Seniors for After Graduation. Minneapolis: University of Minnesota Press, 1966.

JUNIOR COLLEGE ENVIRONMENT SCALES

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The usefulness of the College and University Environment Scales (CUES)[1] as a research and administrative tool for junior colleges is of great interest. Two-year colleges of various types (public, private, and technical institutes) continue to increase in numbers and enrollments. Over 900 of these institutions are recognized by the American Association of Junior Colleges.[2]

A recently completed study has resulted in the development of the Junior College Environment Scales (JCES), and related norm data that is intended primarily for junior colleges.[3] These data and procedures were developed from a sample of 100 public junior colleges. This group of colleges was selected to be as representative as possible of the public junior colleges in the United States. Seven stratification variables were considered. The sample corresponded quite closely with a theoretical sample of the same size. (For detailed procedures, the original study may be consulted.[4])

Descriptions of the Scales

Four scales were derived for the JCES. They may be described in the following manner.

Scale I: Conformity

This dimension appears to be a combination of the CUES Community and Propriety scales. This is not unexpected since these scales, for the sample of four-year institutions, are moderately correlated. Items associated with the CUES Awareness dimension are conspicuously absent. Familiarity with public junior colleges grants this dimension a high degree of face validity. In general, this dimension appears to describe a self-generated community (in the sociological sense) and a self-maintained propriety (codes of behavior, conformity patterns, reward and punishment systems). There appears to be a consciousness by students of group pressures. This dimension describes the college as a community in which persons actively participate in many ways and to varying degrees. The right to participate, however, must be earned through conforming to the group mores. Continued participation and sanction demands continued conformity to these mores. Acceptance by and inclusion in the group depends to a large extent upon conformity. There is little room in the group social system for displays of individualism.

Sociologically this factor seems to describe a college community resembling Riesman's tradition-directed society[5] and Tonnies' Gemeinschaft society.[6] Life is governed by a number of well-established standards and ideals which create a disciplined and traditional social structure. Interaction among students and between students and other college personnel, and the personal nature of these interactions, seems to account for the acceptance and internalization of group norms. This interaction maintains a large amount of visibility by all those participating in group activities. This leads to two important circumstances:

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(1) Through extensive observation of normative behavior, all members of the social structure have knowledge of the norms and values obtaining within the social order. (2) With a large amount of visibility of the role performance of members, fellow members and those in positions of authority in particular are better able to sanction deviant behavior.

Another important characteristic of this scale is that students have internalized the norms and values of the social structure, as opposed to rebelling or deviating from the rigid, and thus many times frustrating, requirements present within the college community. This conclusion is evident in the obedience to common practices, identifications with the school, and general esprit de corps. The second feature which seems to account for the internalization of these seemingly rigid rules is the friendly and personal nature of social relationships. The sentiment of liking is a powerful force in creating a willingness to obey the dictates of those liked.

An environment closely related to the CUES dimension of Scholarship is also implied, but the items clearly indicate a group pressure for work and achievement rather than one resulting from individual initiative of external pressures such as grades and other threats. The main motive dictated by the systems of norms seems to be scholastic achievement, especially assimilating knowledge which will assist in the functional performance of one's community roles.

Scale II: Internalization

The second major dimension resembles the CUES scale of Awareness but with greater emphasis upon individual and personal aspects. A general awareness of social, cultural, political, artistic, philosophical, issues and problems is evident, but the combination of other items emphasize generally an awareness of issues and problems as they either effect or might effect the individual student. Many of the items indicate an awareness through participation rather than intellectual study or awareness. Awareness through involvement and through relatively common everyday experience appears to delineate this awareness dimension from the senior college awareness dimension. When the nature of junior college students, as compared to the majority of senior college students, is taken into consideration, this makes sense. In general, junior college students come from lower socio-economic families, are less concerned and experienced in abstract intellectual treatment of issues and problems, and often have a wider variety of experiences (military service or work) than students in more selective and academically oriented institutions.

Another aspect of this dimension is an awareness of intellectual interests of primarily social and philosophical origin. Conflicting values and social conflicts are of major concern. The emphasis, however, is not toward finding answers or solutions to these problems in an intellectual sense, but understanding and adjusting to their presence as a matter of controlling one's own welfare. The individual concern seems to be "how will it affect me?" or "how shall I respond?"

A final variety of awareness items focuses almost completely on the individual. This might be called self-awareness. Emphasis is placed upon self-fulfillment, adjustment, the development of practical skills (primarily of a social nature), and obtaining knowledge that will best serve the practical purpose of assisting in the adjustment and adequate performance of one's future roles in society.

Scale III: Maturation

The third scale appears to be concerned primarily with what might be called growth, maturity, and responsibility. This factor contains a number of items from the CUES Scholarship scale, indicating activities in the work and achievement area; the CUES Propriety scale, indicating the development and maintenance of rules of behavior; and the CUES Awareness dimension, indicating a degree of personal involvement, concern and interest.

This dimension could describe "junior college inner-directedness." We see a college environment which encourages the development of what Riesman calls "inner-direction."[7] Riesman describes an individual whose source of motivation and direction comes from the individual himself as a result of internalizing generalized goals early in his life. This concept is seen more clearly if we compare it with other-directed individuals. For these people, their contemporaries are the source of direction, and the goals toward which they strive shift with this guidance. Specifically, the college seems to play the function of developing this inner-directedness by encouraging independence and logical and practical reasoning to achieve these maturation goals.

High scores on this scale indicate an environment in which self-determination and direction are encouraged and valued. Maturity, responsibility, personal growth, development of interest, allocation of effort and time, are areas of concern. The development of job skills, social skills, and citizenship, are encouraged. All areas of life are touched upon, but the primary area of concern has to do with the formal educational program (course work, study, and achievement) of the institution.

Scale IV: Humanism

This dimension seems to be describing a student body interested in discussing, sharing and debating ideas and theories of philosophy, politics, music, and theology, outside the classroom. Student extracurricular activities involve such concerns as group discussion, attending lectures by men of science, and visits to art galleries. Emphasis is on group participation as opposed to individual activities, in these (usually) extracurricular academic activities. An accompanying lack of social cohesiveness existing within the student body is demonstrated by many items. Some indicate a general lack of interest in social activities, and others seem to indicate that destructive and mischievous activities are especially unpopular (which is to be expected where there is a great concern for constructive group activities such as debate, discussion, and sharing of academic subjects).

Scoring

If two-thirds or more of the respondents replied in the keyed direction on an item, the scale score for that college was increased by one point. If one-third or less of the respondents replied in the keyed direction, the scale score was reduced by one point. To eliminate negative scale scores a constant equal to the number of items in this scale was added. Since the first scale was defined by 46 items, scores on this scale could range from 0 to 92. Similarly, since the second, third, and fourth scales were defined by 26, 30 and 21 items, respectively, these scale scores could range from 0 to 52, 0 to 60, and 0 to 42.

Table 1 indicates the intercorrelations among these four dimensions, with means and standard deviations. The complete orthogonality present in the factors that resulted from the original preliminary analyses has been reduced. This necessarily accompanies the selection and equal weighting of items and the scoring techniques chosen. The four dimensions, however, still exhibit considerable independence and the correlations are in the expected directions. For example, Scales I and IV would be expected to exhibit a negative correlation whereas the remaining scales would be expected to exhibit moderate positive correlations.

Table 1

INTERCORRELATIONS MEANS AND STANDARD DEVIATIONS
OF JCES SCALES FOR 100 COLLEGES

	Scale			
Scale	I	II	III	IV
I - Conformity		.06	.49	-.31
II - Internalization			.33	.39
III - Maturation				.37
IV - Humanism				
Mean	54.1	24.9	45.2	14.2
Standard Deviation	11.6	6.4	6.1	4.9

Reliabilities were obtained for the JCES scales by adapting the Kuder-Richardson Formula 20 to the type of data obtained. Relevant statistics are found in Table 2.

Table 2

RELIABILITIES OF JCES SCALES AND FREQUENCY DISTRIBUTIONS OF
ITEM CORRELATIONS (SCORED AS -1, 0, +1) ON JCES SCALES
FOR 100 PUBLIC JUNIOR COLLEGES

	Reliability	Item Correlations on Scale Scores				Total Scale Items
Scale		.40	.40-.50	.50-.60	.60	
I - Conformity	.94	5	10	20	11	46
II - Internalization	.88	4	7	9	6	26
III - Maturation	.91	8	7	10	5	30
IV - Humanism	.86	2	9	7	3	21

Results

Table 3 reports the correlation coefficients between scale scores and nine indices descriptive of the output of junior colleges. The extent to which high or low scores on these indices might be positively or negatively valued is not of concern. This type of evaluative decision must ultimately be made by each individual college. The extent to which relationships exist between these measures and Junior College Environment Scales scores would be of importance as a college takes steps to achieve that which it values. The Associate Degree Index was computed by dividing the number of students completing an associate degree for a given year by the number of students enrolled in transfer programs at the beginning of the year. The Transfer Index was similarly computed by dividing the number of students transferring to a senior institution during or at the end of a year by the number of students enrolled in transfer programs at the beginning of the year. Dividing the number of students who completed occupational programs during a year by the number of students enrolled in occupational programs at the beginning of the year provided the Occupational Program Completion Index. Similarly, dividing the number of occupational students finding employment during a year in an area for which they were trained, or related area, by the beginning occupational student enrollment for a year, provided the Occupational Students Employed Index.

Table 3

CORRELATIONS BETWEEN JCES AND NINE OUTPUT INDICES FOR
100 PUBLIC JUNIOR COLLEGES

Output Indices	I Conformity	II Internalization	III Maturation	IV Humanism
Associate Degrees	.05	-.24*	-.18	-.25**
Transfers	.07	-.20*	.04	-.18
Occupational Program Completions	.03	-.06	-.04	-.01
Occupational Students Employed	.08	-.11	-.18	-.13
Percent Completing BA Degree	.08	-.13	.09	-.02
Percent on Probation	-.06	-.05	.01	.09
Percent Dismissed	-.10	.04	-.05	.03
Percent in Transfer Programs	.24*	.10	.15	.02
Percent in Occupational Programs	-.16	-.09	-.25*	-.08

Note: * Significant at the 5 percent level
** Significant at the 1 percent level

The Percent completing BA Degree Index was computed by multiplying the proportion of students transferring by the proportion of transferred students that eventually complete the BA degree and converting to a percentage. The sixth and seventh indices were computed by dividing the number of students placed on probation during the year or dismissed from the institution for academic reasons, by the total enrollment in the institution. Similarly, the eighth and ninth indices were computed by dividing the number of students enrolled in essentially transfer programs and the number of students enrolled in occupational (technical and vocational) programs by the total institutional enrollment.

In general, the correlations reported in Table 3 are relatively small in absolute value. In part, this can be attributed to the error existing in the nine output indices. The problems associated with generating such data for a national representative sample of colleges is described in the original study.

Examining the statistically significant correlations, it is observed that Conformity is positively correlated with the percentage of the student body enrolled in transfer programs. Taking into consideration the group social pressure characteristic of this environmental dimension, and remembering the general social emphasis placed upon collegiate education and the status accorded such education by society and individuals, this relationship is to be expected. Similar concepts would serve to explain the negative relationship between Maturation and the percentage of students enrolled in occupational programs. It should be noted that the two corresponding correlations, (Maturation versus Percent in Transfer Programs and Conformity versus Percent in Occupational Programs) are in the expected direction, although they fail to reach the five percent level of significance. The relatively strong concern with work, achievement, individual development, and responsibility in the Maturation scale further explains this relationship. The negative correlations between Internalization and the Associate Degree and Transfer indices is somewhat surprising. It could be that institutions placing greater emphasis upon Internalization (of values, skills, knowledge), are also those in which there is less concern for formal completion and granting of degrees. The negative correlations between Humanism and these two indices, although that for transfers does not reach the five percent significance level, further indicates that a concern for individual achievement and value, interest in various topics for their own intrinsic worth, is likely to be associated with less concern for the formal symbols of achievement recognized by the society, such as degrees.

Table 4 reports the correlations between JCES scores and mean ratings on a number of items by students at the 100 public junior colleges. For each item the students responded to a five point rating scale, indicating the extent to which they were satisfied with the college (items 1-3), the extent to which they thought they were making progress toward a number of generally accepted educational goals (items 4-19), and the extent to which they participated in a number of activities (items 20-35). The items were scored so that higher ratings were associated with greater indications of satisfaction, achievement, and participation.

Even cursory examination of Table 4 indicates that a larger number of statistically significant relationships exist between junior college environments and judgments and opinions by students. The relative strength of the relationships are also greater than those reported in Table 3. Hence it must be concluded that college environments do impinge upon students in rather direct fashion.

Table 4

CORRELATIONS BETWEEN JCES AND MEAN RATINGS ON 35 ITEMS
AT 100 PUBLIC JUNIOR COLLEGES

	I Conf	II Inter	III Mat	IV Hum
1. How much of the time do you feel satisfied with your college?	.53	.36	.72	.21
2. How much do you like your college?	.48	.45	.69	.34
3. To what extent have you found groups in the college which were really congenial and with which you felt happy?	.74	.04	.45	-.25
4. Gaining experience and skill in getting things done promptly and properly.	.45	.16	.38	.23
5. Developing abilities to communicate and work effectively with groups and individuals.	.39	.09	.20	-.27
6. Developing the ability to write, speak, and communicate clearly, correctly, and effectively.	.17	.17	.39	.07
7. Vocational training--skills and techniques directly applicable to a job.	.28	-.14	-.20	-.43
8. Adjusting to the behavior expected in your college and social groups.	.64	.08	.33	-.40
9. Knowing the accepted rules and customs of the social groups and organizations to which you belong.	.54	.02	.18	-.36
10. Learning to get along well with others even though they may think and act differently from you.	.29	.03	.17	-.24
11. Developing an ability to think critically.	-.13	.13	.17	.12
12. Background for further education in some professional, scientific, or scholarly field.	.05	.25	.38	.26

Table 4 Continued

	I Conf	II Inter	III Mat	IV Hum
13. Developing an understanding and appreciation of the concepts, attitudes, and methodology of science.	.03	.29	.23	.37
14. Ability to define and solve problems in a rational and systematic manner.	.01	.20	.20	.19
15. Knowledge of and facility in applying principles of modern technology.	.30	.08	.02	.27
16. Developing an interest in reading and learning beyond the requirements of college classes.	-.05	.34	.38	.46
17. Acquiring an appreciation of ideas and their usefulness.	-.04	.36	.36	.39
18. Understanding major issues and problems that confront modern society in America and around the world.	-.02	.45	.29	.36
19. Developing an appreciation and enjoyment of art, music and literature.	-.04	.56	.31	.46
20. Intercollegiate and varsity sports as a participant.	.39	.03	-.17	-.35
21. Intramural sports as a participant.	.44	.07	-.13	-.43
22. Attending sports events as a spectator.	.55	.06	.00	-.57
23. Publications: college paper, yearbook, etc	.32	.06	.00	-.04
24. Music organizations: chorus, band, etc.	.21	.12	-.01	-.08
25. Dramatics.	.26	.15	-.02	-.01
26. Student government.	.29	-.10	.02	-.09
27. Religious groups.	.62	-.02	.07	.32
28. Academic clubs, honoraries	.31	.12	-.10	-.35
29. Social groups: fraternities, etc.	.18	-.06	-.22	-.21

Table 4 Continued

	I Conf	II Inter	III Mat	IV Hum
30. Hobby groups.	.27	.10	.03	-.13
31. Attending musical or dramatics events: school concerts, plays, etc.	.20	.21	.03	-.13
32. Debating groups.	.16	.10	.09	.07
33. Service groups.	.36	.13	.14	-.13
34. Visiting art exhibits, art galleries, museums, etc.	-.20	.57	.09	.51
35. Attending lectures by guest speakers	.05	.35	-.03	.06

Note: Underlined correlations are statistically significant at the 1 percent level of confidence.

Examining the items that are positively correlated with Conformity, it is observed that students report greater satisfaction with the college (a general liking for the college); that they have been able to find congenial groups of students; that they feel they are making progress toward educational goals that involve getting things done, working with groups, employment related skills, adjusting to group norms and expected behaviors; and that they report greater participation in numerous activities. Those activities exhibiting the higher correlations with Conformity scores appear to be those that primarily require group participation and whose rewards obtain from other students (such as sports, publications, religious groups, service groups), as opposed to those that more strongly emphasize or require individual participation and rewards that are earned primarily through individual efforts and achievement as opposed to group efforts (dramatics, hobby groups, debating groups, and attending musical and artistic events).

Internalization scores are correlated positively with greater satisfaction and liking of the college, greater achievement in preprofessional areas (item 12), developing interests, appreciation for and understanding of science, reading, ideas, social problems and issues, and the fine arts (items 13, 16, 17, 18 and 19). In general, this dimension is not strongly associated with participation in activities. The only two positive correlations that are statistically significant indicate that visiting of art exhibits, art galleries, museums, and attendance at guest lectures are associated with higher internalization scores.

Maturation scores are positively associated with greater reported satisfaction, liking of the college, and ability to find congenial groups. Also, greater judged achievement is reported in the ability to get things done, communicate with others, adjusting to expected behavior, preprofessional education, interest in reading, appreciation of ideas and their usefulness, major social problems and issues, and the fine arts. None of the items concerned with activities are significantly related to this dimension.

Scores on the Humanism scale are positively associated with satisfaction and liking of the college, but negatively associated with the ability to find congenial groups. Negative correlations exist between this dimension and judged achievement in the ability to work with others, develop employable skills, adjust to expected behavior and accept rules; but positive correlations are associated with greater achievement in preprofessional education, appreciation of science and technology, reading, ideas, major social issues and problems, and the fine arts. In general, the Humanism dimension is negatively associated with participation in activities. In particular, those activities strongly based upon group participation and group reward systems, such as sports and clubs, exhibit much less participation in the presence of higher Humanism scores. Only two of the activities are positively correlated, reporting participation in religious groups (with likely concern for social issues and problems) and visiting of art exhibits, art galleries, and museums.

Summary

The items associated with these four environment dimensions offer some construct validity for each dimension. Students are more satisfied with colleges that exhibit higher scores on any of these dimensions. Conformity is associated primarily with greater reported success in the development of social and communications skills. Of the four dimensions, it is most strongly associated with student participation in activities. Internalization is not strongly related to success in the development of conceptual and intellectual skills and interests. The two activities that are associated with this dimension are also indicative of intellectual and conceptual types of behavior. Maturation is associated with greater reported success in developing skills of a social nature, primarily adapting to expected behaviors of social groups, communications, and "getting things done." Although this dimension is apparently unrelated to participation in group activities, at least those identified in specific terms, it is associated with success in finding congenial groups. This pattern coincides quite closely with the emphasis in the Maturation scale upon individual growth, responsibility, and individualism. The Humanism scale is negatively associated with success in group and social skills, but positively associated with success in skills primarily conceptual and intellectual in nature. In general, this dimension is negatively associated with participation in activities, except for religious groups, and visiting art exhibits, art galleries, and museums.

Footnotes

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2. 1967 Directory of Junior Colleges. Washington, D. C.: American Association of Junior Colleges, 1967.

3. Vernon L. Hendrix, Functional Relationships of Junior College Environments and Selected Characteristics of Faculties, Students, the Administration and the Community. Report of Cooperative Research Project No. 2849. Minneapolis: University of Minnesota, 1967.

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ASSESSMENT OF INTELLECTUAL CHANGE

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Changes in thinking and behavior are presumed to be basic outcomes of a college education. Effective assessment of the variations in quality, quantity, and direction of such changes involves measuring heterogeneous groups of students who have been subjected to a wide variety of educational experiences. Students change in many ways, but according to the major objectives of a college education, certain kinds of change should be related to definable aspects of the educational process. For example, a curriculum which is based upon a particular intellectual orientation (e.g., art by an aesthetic emphasis or physics by a theoretical approach) should have the effect of increasing students' commitment to that orientation. Further, such an outcome should be more prominent among students who enter with a fairly high level of initial orientation congruent with the intellectual direction of their studies. This conjecture has some support in the earlier findings of Stern, Stein, and Bloom (1956).

Problem

The topic of behavioral change resulting from education has several exceedingly important aspects from the standpoint of research, such as the process of change per se and the causes for change. In this analysis, for example, the focus is on the methodology of assessing change. Two methods of change analysis will be presented and compared, utilizing data collected on samples of male science students, first as entering freshman and later near the end of the senior year. A specific expectation follows from this general statement: an intellectual orientation toward theoretical, scientific thinking, as well as the degree of interest in problem-solving activities, will tend to increase for those students who major in physics as compared to those in less theoretical sciences. A chief method commonly used to assess change involves computing the mean score difference of a trait measured on a precollege and postcollege basis. This average difference serves as an indication of the amount and direction of change. However, it is probably fallacious to attempt to interpret a single mean score difference without supportive and clarifying data. This method also poses a problem of interpretation with regard to the relationship of initial (i.e., freshman) score level and the computed difference scores.

A second method utilizes comprehensive personality change indications. This method is a consideration of intra-individual change, across a number of personality variables, in terms of the type, as well as the degree and direction of change. Subsequent to assessment of overall change patterns for each student, analyses of change in the specific trait of theoretical orientation are made as a function of these change patterns.

Procedures

A personality assessment instrument called the Omnibus Personality Inventory (OPI), was administered in a selective school of science to all students who entered in 1962 and 1963. Four years later the graduating students in both classes

12/13

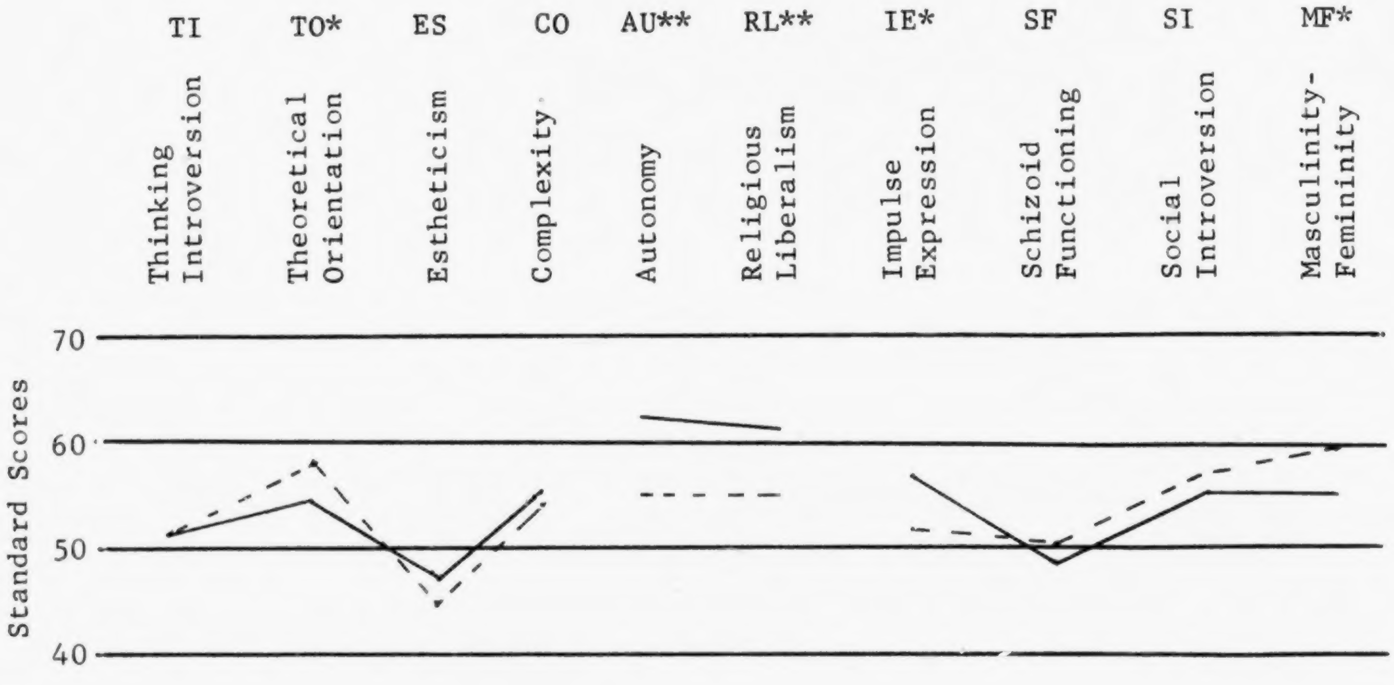
(N=90 males) took the Inventory again. The OPI includes four scales measuring several aspects of an intellectual disposition one of which, Theoretical Orientation (TO), assesses the degree of interest in problem solving and an inclination toward theoretical, scientific thinking. The OPI also measures the social-emotional adjustment of students and indirectly registers the degree of authoritarian thinking.

First Method

Mean scores computed for the entering students on each OPI scale were compared to scores obtained for the same students near the end of their four years. Freshman and senior OPI profiles are shown in Figure 1. A short description of the profiles and the differences shown across them will be helpful as a background for discussion and interpretation of specific changes.

Figure 1

Standard Score Means on Nine Omnibus Personality Inventory Scales for Ninety Male Science Students as Freshmen (--) and as Seniors (——)



Note: *Significant at the .05 level of confidence.
** Significant at the .01 level of confidence.

Group means on the OPI for these science students show minimal difference between freshman and senior testings. The personality growth represented is neither profound nor as large as students may be expected to demonstrate. The first four scales reflect intellectual attitudes and orientations to the academic. No growth is indicated in this area by differences in mean scores. Indeed, the only change is a negative one on Theoretical Orientation. It appears that both as freshmen and seniors, these students are average in their preference for reflective thought, particularly of an abstract nature (TO), and somewhat above the norm for college students in their preference to deal with complex, ambiguous, (rather than simple) problems as reflected by the Co scale. As seniors, they remain lower on esthetic attitudes and interests than the other components of intellectual disposition measured by the OPI. The downward shift noted on TO will be discussed further, after a brief look at the remaining scales.

Mean score changes on Autonomy (Au) and Religious Liberalism (RL) are small, but statistically significant in the direction of less authoritarian, dogmatic thinking. Moderate improvement in social-emotional adjustment is shown only by an increased score on Impulse Expression (IE), while Schizoid Functioning (SF) and Social Introversion (SI) scores remain unchanged. It is quite possible that the small but significant differences on Au, RL, and IE are chiefly due to maturation and normal development during the postadolescent years.

The mean score change on the Masculinity-Femininity scale is toward more feminine interests away from the stereotyped masculine role. This change is typical for men who attend institutions of higher education. It is also in agreement with the negative mean score change found on TO for these students because the theoretical, scientific aspect associated with masculine interests is a component of the dimension measured by MF.

In sum, the mean score differences found for both classes across the OPI profiles give the impression that little essential change occurred over the four years. The positive changes demonstrated, toward less authoritarian thinking and freer expression, represent some growth. However, the lack of intellectual change in general, and the negative change on TO in particular, merits analysis of TO change as it differs among majors.

The hypothesis that the students who majored in physics would demonstrate positive change on TO was thus entertained. The mean score differences on TO for each of the four major programs in this school are given in Table 1.

Table 1

FRESHMAN AND SENIOR MEAN SCORES AND DIFFERENCES ON OPI SCALE TO FOR STUDENTS IN THE FOUR MAJOR PROGRAMS

	Chemistry	English	Mathematics	Physics	Total
Senior	55	50	55	58	55
Freshman	59	55	62	60	59
Difference	-4	-5	-7	-2	-4

The differences between freshman and senior scores do not reach statistical significance. The senior mean score for students majoring in physics is not higher than the freshman mean score. This mean score difference, finding that physics majors are no more oriented toward theoretical thinking after a four-year education strongly emphasizing theoretical science than the other majors with less emphasis, is anomalous.

Interpretation of such a finding should not be made without consideration of a regression effect and of differences in initial freshman score levels. In this case, the lack of positive change is not merely accounted for, in part or entirely, by regression, since those students scoring below the group mean as freshmen also tend to score lower as seniors. A factor related to regression is a possible ceiling effect on the TO scale. It might be argued that for students entering with a very strong theoretical orientation, the TO scale does not allow enough latitude for an increased score at the senior testing. Among these physics majors scoring above a standard score of 60, there are several who score in the 70's as seniors, an indication that the TO scale can accommodate increases at higher levels.

A third, often debated problem encountered in assessing mean score change may be mentioned--whether or not to correct for initial score differences. Other investigators have found instances, similar to this one, in which the use of raw (uncorrected) initial scores showed that students in majors with lower freshman scores gained more during college. However when the effect of initial score was parceled out, it was found that the higher the groups were, the more they gained (Bereiter, 1963). In instances where individuals are assigned at random to the groups being compared, correction of initial scores is desireable. But it certainly cannot be assumed that students choose their majors in a random manner. As Lord points out:

> If, as often happens, randomized assignment is impossible, then there is often no way to determine what is the appropriate adjustment to be made for initial differences between groups, and hence often no way to show convincingly by statistical manipulations that one treatment (i.e., major curriculum) is better than another. (Lord, 1963)

Thus, findings of this nature, in contradiction to expected results, have caused the staff at the Center to explore alternative approaches to mean score differences to obtain valid differentiation regarding the amount and the type of actual change occurring in a group of students.

Second Method

A second method which attempted to decipher more of the truth regarding change involves a procedure of first assessing the overall story on personality change for each student. This procedure required an individual reading of the paired freshman and senior OPI test profiles and an examination of results for subclusters and change across the total set of scales. The analyses of intra-individual results permitted each student to be assigned to one of nine categories. In practice this is a form of profile analysis to determine the variety of resulting changes. The mutually exclusive change categories reflect both the type and degree of change. There are five positive change categories, three representing negative change and a nonchange category, all of which involve an assessment of both intellectual and social-emotional adjustment change.

Three positive change categories reflect large, average, and small changes toward an enhanced orientation to academic pursuits. This general intellectual change may also represent differences in style of learning, which is related to greater freedom of thinking and independence of judgment. Positive change also subsumes a move away from dogmatic religious beliefs and toward "greater" or more normal mental health. A fourth positive change category refers to change restricted to less authoritarian thinking. Persons who change in a positive direction on the Au and RL scales are at a somewhat higher level of learning readiness, even though there are no concomitant changes on the first four scales. The fifth positive change category includes individuals who show increased social-emotional adjustment which has the effect of freeing them for growth in intellectual areas.

The three negative change categories--small, average, and large--are assigned to students who show varying degrees of change in a downward direction depending on the number of scales and the amount of change involved. Students who become more authoritarian, or schizophrenic in their thinking or feelings, or less interested in academic matters during college, are assigned to negative change categories.

The nonchange category includes profiles of students that are virtually identical from freshman to senior testing. These students cannot be regarded as completely static individuals, but there are no indications of changes on the OPI scales for them. The consistency of no measureable differences across all the scales warrants an assumption of stability of thinking and behavior unlike, at least, those who show changes on several scales. The nonchange category also includes some individuals who exhibit a combination of positive and negative changes; that is, growth in one area of the profile which is negated by a downward trend in another area. An example would be a student who increases his measured intellectual orientation but, at the same time, becomes more emotionally disturbed, a change which probably has a deleterious effect on his academic growth.

The analysis of the paired profiles for each of these male science students resulted in the distribution shown in Table 2:

Table 2

PERCENTAGES OF SENIORS IN THE FOUR MAJOR
PROGRAMS EXHIBITING DIFFERENT TYPES OF CHANGE (OPI)

Types of Change	Chemistry	English	Mathematics	Physics	Total
Positive	46.1	43.4	37.5	52.6	46.6
Nonchange	23.1	17.3	37.5	39.4	31.0
Negative	30.7	39.3	25.0	8.0	22.3

As compared to the mean score difference shown in Figure 1, change demonstrated via readings of individual profiles is more noticeably positive for the total groups. This finding immediately introduces a reservation about the story coming from mean score differences alone. More actual positive changes took place among these students than was reflected by single scale differences.

The distribution of students in the four majors in the change categories indicates that the group of physics majors includes fewer negative changers than the other three majors. On the basis of this added information, intellectual change in theoretical orientation for physics majors was again assessed according to overall positive personality growth or nongrowth. Differences on TO by type of overall change are shown in Table 3:

Table 3

MEAN SCORE CHANGE ON OPI SCALE TO FOR STUDENTS
EXHIBITING POSITIVE AND NON-POSITIVE CHANGE
AS DIFFERENTIATED BY MAJOR PROGRAM

Types of Change	Chemistry	English	Mathematics	Physics
Positive	-1.0	-1.0	-1.2	+2.9
Non- and Negative change	-2.3	-6.7	-5.4	-3.5

This analysis provides a vivid example that the relationship between major and TO change is moderated by general positive change. Physics majors who experience general positive personality growth are more likely to exhibit concomitant increase in Theoretical Orientation. Because the effect of increase on TO is not observed for positive-change students in the other three majors, it must be assumed that there is an interaction among some aspects of the physics curriculum, faculty, and the physics students exhibiting overall growth which optimizes, so to speak, increased commitment to theoretical matters. Thus, the hypothesis of increase on TO for physics majors is not rejected but modified in line with the variable of overall change.

Conclusion

The simple and legitimate method of using a mean score difference on single scales as a reflection of change in college students is inadequate if that change is modified by or related to other variables. This state of affairs is probably more often the rule rather than the exception. A method of analysis should take into account the variety of students and their intra-individual personality patterns. Single scale mean score differences provide meager, and, at times, misleading information about the real nature of student change.

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VOCATIONAL DISPOSITIONS OF THE NONCONFORMIST, COLLEGIATE DROPOUTS

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It is a cultural fact that youth and adulthood are considered two rather differentiated periods in the life cycle. Anthropologists have repeatedly shown that preliterate societies tend to institutionalize the transition from one stage to the other. In contemporary Western society, however, a paradox lies in the fact that the transition period has been continually extended and the formal boundaries correspondingly made more ambiguous. Within this context of the opportunity to prolong socialization into adult roles, the conditions were set for a widespread youth culture.

This relatively recent tradition of a pervasive, diversified youth culture has become an increasingly important social phenomenon. The postponement of adult status is taking place concomitantly within a society that reflects not only rapid social and technological change but also lag and imbalance. It is inevitable, therefore, that such a condition will produce social and psychological conflicts for youth, as well as others, who must somehow adapt to the strains thus created.

Erikson (1959) has characterized our youth culture as a psycho-social moratorium on adulthood which serves a positive function in resolving generational discontinuities. The span of time provides adolescents and young adults with an opportunity to complete their primary task of forming and achieving a sense of self-identity. The word achieve is crucial here. Identity is not simply given by the society in which the young person lives. He must make his own unique synthesis of incompatible models and ideals offered by society. The more incompatible and changing the present components from which the sense of identity must be built and the more uncertain the future for which one attempts to achieve identity, the more difficult the task becomes.

The psychologically important task by no means characterizes all young Americans to the same degree. For the majority of youth in their teens and early twenties--members of the extensive subculture typically distinguished for its conformity both to the dominant mores of the mass youth cult and current values of society--the period of identity formation is normally weathered with relatively little strain (Katz and Sanford, 1966). Such individuals have learned the practice of ego-restriction to avoid psychological crises. Others have painfully and defiantly struggled to develop and establish the uniqueness of their identity. Those individuals most affected by identification crises are youth who strongly perceive a sense of frustration. Generally, this frustration is associated with a feeling of alienation, a feeling of being outside the mainstream of society, regardless of whether the effect towards society is positive, negative, or ambivalent, and is manifested in psychological forms by maladjustment or in social forms by nonconformity or deviance.

To social scientists interested in the area of adolescent and post-adolescent youth, such individuals are important subjects of research, especially those youth with a propensity for seeking their identity within the social vanguard already existing within the framework of American society and who generally feel most acutely the strains of, and for, social change. Subculturally, by their very deviance from the social norm, they not only help define that norm by juxtaposition but also offer alternatives for social change. However, the particular descriptive, often disjunctive, variables directly and indirectly indicate various combinations of social and psychological stress, adaptation, fulfillment, and failure.

Subjects and Method

Recently, both public and academic attention has been directed towards nonconforming youth subcultures. One such social manifestation is particularly prevalent at the University of California at Berkeley and is also characteristic of other major universities such as Harvard, Wisconsin, and Columbia: a subculture or "underground" of nonstudents. They represent a diverse collection of collegiate-age youth and their older counterparts who are, in a way, an epitome of those young people separated from the traditional middle class and its values. Nonstudents--a term with generally unsympathetic connotations in the public mind--are persons who are neither formally registered as students nor members of the conventional work force, but who have mingling associations and impacts with student culture and vice versa. Most have had some college education, have dropped out, indefinitely; and while often professing disdain for formal academic study and its stifling effects they are attracted nevertheless to the university environs as a source of social, cultural, and intellectual stimulation, acceptance, and sanctuary. They live a marginal existence reflective of their unconventional role.

To classify Berkeley's nonstudent subculture in general terms may be an oversimplification. The group has been unofficially estimated to contain a floating membership of approximately 3,000, and to the astute observer it obviously is a very diverse community. However, regardless of the individuality of its membership, the major characteristics of the subculture tend to make themselves known and thus attract other members of a compatible nature. It is, basically, a libertarian society illustrative of a critical reaction against social hypocrices, restricted standards, a materialistic way of life, and the dehumanizing influences of modern institutions. In historical context, they are a contemporary expression within the long tradition of bohemian, rebelling, nonconforming youth succinctly discussed by Matza (1961).

This paper is based on partial data from a comprehensive socio-psychological study of 151 Berkeley nonstudents who volunteered to undergo intensive probing by responding to a lengthy interview questionnaire and a number of psychological instruments. Because the parameters of this population are rather ill-defined and changing, a method referred to by Campbell and Pettigrew (1959) as the "snowball technique" was used. By this method all available assesses into the particular group are initially used and other respondents were gained by a referral method. Enough different inroads were used in recruiting the subjects that they likely typify a fairly broad range of this population. Almost without exception the subjects were conscientious in their responses, uninhibited, and generally stimulated by the focus of the research materials.

For comparative purposes a cross section of the University of California student body at Berkeley, a rather scholastically elite population of youth, seemed obviously appropriate as a reference group in this initial phase of the study and was randomly obtained. This sample of 56 students was, by comparison, more "clean cut" in appearance and tended to be somewhat more placid in their behavior during the data collection, a stance perhaps defined by their student role. Approximately two-thirds of the subjects in each sample, selected without bias, were males. The average age within the two groups was similar, approximately twenty-one.

Biographical, Sociological and Psychological Background

The basic descriptive data that differentiated the nonstudent from the student sample gives pertinent, contrasting information. Summarizing some of the statistically significant group differences, the nonstudents, as compared to the students, were (1) more nonconforming in their personal grooming and attire; (2) more estranged from their families in terms of contactual indices as well as in the extent to which they disagree about intellectual, religious, and political concepts and the subjects' future goals; (3) more financially on their own but less employed; (4) more dissatisfied with their previous formal education; (5) underrepresented in the major political parties and far more active in such organizations as CORE and SNCC and more active in civil rights affairs and Vietnam protests; (6) less oriented towards the traditional, formal religions; (7) more inclined to approve of marriage age to be in the late, rather than early, twenties; (8) more tolerant towards nonmarital sexuality and homosexuality; and (9) more likely to spontaneously mention experimenting with drugs (Watts and Whittaker, 1967).

Psychologically, many significant mean differences between the two groups were noted on the basis of formal instruments (Whittaker, 1967). On these tools the males and females of the nonstudent sample tended to have very similar profiles. The nonstudent profiles also were more pronounced, having both higher and lower variables, with smaller standard deviations, similarly indicating, expectedly, the homogeneity of the group. In general, since the same individual scale comparisons, between samples, by sex, statistically differentiated the nonstudents from the students, data could often be collapsed within groups for simplification of presentation without loss of information.

Nonstudents of both sexes were significantly unlike students on the Allport-Vernon-Lindzey Study of Values, in that they ranked values in the same manner: Esthetic (high), Theoretical, Social, Political, Religious, Economic (low). The extreme scales were particularly divergent. The student males were high on Theoretical and Political, low on Social and Religious, and the student females were high on Esthetic and Theoretical but low on Economic and Religious. The nonstudents were significantly higher on Estheticism, Complexity, Autonomy, Religious (liberal) Orientation, and Impulse Expression, and lower on Personal Integration, Anxiety Level (more anxious), Practical Outlook, Masculinity, and Response Bias as measured by the Omnibus Personality Inventory (Heist and Yonge, 1967). On the Adjective Check List (Gough and Heilbrun, 1965), where the student group profiles remained relatively near the norms, the nonstudents scored significantly higher on Lability and lower on Self-Control and Personal Adjustment; on the need scales, nonstudents were higher on Autonomy, Change, Exhibition, Succorance, and lower on Order, Endurance, Deference, Achievement, and Dominance.

In general an integrated interpretation of the psychological data results in a composite portrait of the nonstudent, as contrasted to the student, as being more intellectually disposed and potentially creative, more independent and nonconformist, more flexible and less authoritarian, more feminine, more alienated and psychologically maladjusted (but certainly not pathologically), displaying a greater propensity towards impulsivity, novelty seeking, avoidance of routine and competitive confrontation, and presently somewhat ineffective, especially in academia as generally structured, because of strong psychological needs coupled with reduced self-disciplinary controls. The group profile presents a stereotypic pattern suggestive of a syndrome of personality conflict and stressful identity seeking.

Vocational Disposition

The subjects were asked to state their previous, present, or intended, college majors as an initial indication of vocational orientation. A much larger proportion of nonstudents than students majored, or intended to major, in the creative or fine arts (25 percent nonstudents compared to 7 percent students) and the humanities (38 percent and 25 percent, respectively). The nonstudents were underrepresented in the more pragmatic fields such as business, the physical and biological sciences, and engineering. There was little difference in the representation from the social sciences (26 percent for nonstudents versus 30 percent for students). Approximately half of the students felt various degrees of uncertainty as to the wisdom of their choice of major. Nonstudents were more uncertain but this was, of course, ex post facto.

Tentative Vocational Decision

A further index of vocational commitment was obtained from the responses to the question concerning what, if any, tentative vocational choices have been made. The most obvious difference between the subgroups was the tentative choice of vocations associated with the creative arts on the part of the male and female nonstudents. Such responses as artist, sculptor, architect, decorator, writer, poet, singer, dancer, musician, actor, drama director, and film maker were subsumed under this rubric. These creative, communicative occupations were tentatively chosen by two-thirds of the nonstudent males and females and reflect the apparently strong esthetic and expressive interests of this group. Correspondingly, 14 percent of the male and 30 percent of the female students mentioned such occupations.

Another indication of the nonstudents' less pragmatic orientation, and significantly so, is that only 8 percent of the nonstudent males tentatively chose vocations within the theoretical and applied sciences, law or business, whereas 58 percent of the student males did so. Similarly, only 19 percent of the nonstudent females indicated teaching, and none the sciences, whereas 50 percent of the student females chose teaching and 10 percent the sciences. There were no differences between nonstudent and student males regarding teaching. Approximately 15 percent in both cases made such references. Nor were there significant differences concerning the social sciences and humanities; 4 percent of the male and 10 percent of the female nonstudents mentioned such tentative vocational areas as did approximately 10 percent of both the male and female students. Lastly, about 10 percent of the nonstudents of each sex either had made no decisions, even tentatively, or responded with vocationally noncommitted statements such as "being free," "living," "being a person," or "wanderer." All students made a tentative, formal vocational choice.

Following this question, the subjects were asked how certain they felt about their tentative vocational choice. There was little difference between groups or sexes. Approximately 70 percent stated varying degrees of certainty, and the remaining 30 percent responded with varying degrees of uncertainty.

It was interesting to observe the indication of a shift, especially on the part of nonstudents but also reflected by students, between the academic major responses and the tentative vocational decisions. To the extent that the categories in each case are somewhat comparable, note that a quarter of the nonstudents had majored, or intended to major, in the creative or fine arts whereas three-fifths tentatively chose vocations in such an area. This shift was apparently at the expense of the humanities and social sciences where one-third and one-quarter, respectively, had majored, but less than one-tenth chose occupations in these areas.

Ideal Vocational Choice

At a later point in the data collection a freer, more imaginative, less mundane, open-ended question was presented to detect yet another facet of personal or vocational orientation. The subjects were asked, "If anything were possible, what would you ideally like to be?" The responses were diverse and eventually a classification system was developed utilizing 15 general categories. Again, contrasting the four subgroups, the male and female nonstudent group responses were rather similar. The female student responses were somewhat related to female nonstudents, and the male students were most divergent from the others in terms of their continuing, more traditionally vocational responses.

The five or six most frequent categories obtained for each of the four subgroups accounted for approximately 80 percent of their individual responses. The male nonstudents' most frequent response category (28 percent) was labelled Individualistic Person because reference was made not to a vocation per se but to a desire for unique, personal development. This was followed, in descending rank order, by Creative Artist (27 percent), Versatile Person (two or more contrasting response-concepts mentioned), and equally Educator and Religious-Mystic. Rather similarly, female nonstudent categories in rank order were Individualistic Person (21 percent), Creative Artist (20 percent), Versatile Person and Educator equally, and Social Servant. The female student categories were somewhat the same but in different rank order--Educator (24 percent); Versatile Person, Social Servant, and Individualistic Person equally; Creative Artist; and Governmental-Politico. Contrastingly, male student rankings were Governmental-Politico (28 percent), Individualistic Person and Social Servant equally, and then equally Versatile Person and Scientific Researcher. It is significant that the nonstudent male and female responses resulted in first place ranking of the category Individualistic Person, the category primarily concerned with answers involving ideal, personal self-development, and that such responses indicated that these individuals projectively reacted to the personal, rather than vocational, possibilities of the unstructured question. It is also of importance that both male and female nonstudent replies resulted in Creative Artist as the immediate second most frequent category. This category reflects esthetic interests, needs for creative self-expression and, in all likelihood, sensitivity to the introspective and emotional self.

Avocational Creative Needs

The three previous areas of occupational orientation--academic major, tentative vocational choice and ideal existence--indicated that the esthetic, creative focus was significantly stressed more often by the nonstudents in comparison to student responses. Observational data would predict such a trend. An open-ended item was included in the questionnaire that might tap not only the vocational expression but also the avocational motivation to creative behavior on the part of the subjects, especially those not involved in the areas traditionally defined as creative. Regardless of their previous responses, when asked if they had the urge to express themselves creatively, approximately 95 percent of the male and female nonstudents replied in the affirmative, and 80 percent of the female and 75 percent of the male students similarly responded. In respect to those who answered "Yes," the response to "If so, how?" resulted in the use of 12 categories and a rather similar frequency distribution for the four subgroups. The Music, Drawing-Painting, and Writing (prose, poetry, plays) categories each accounted for approximately 20 to 25 percent of the responses in both subgroups and thus included two-thirds to three-quarters of each distribution. In the remaining, less frequently used categories, there was a strong tendency for nonstudent and student females to mention Dance as compared to their male counterparts. These results indicate, particularly in conjunction with the previous findings, that although more nonstudents than students are vocationally oriented towards the creative arts, those nonstudents that are not so oriented apparently are aware of such urges avocationally. Such tendencies are part of the basic creative syndrome. Considering the previous trend of the pragmatic disposition within student vocational foci, in conjunction with the psychological data, especially in the males, their artistic, creative urges might be tentatively considered as less vocationally centered and more secondarily, avocationally oriented.

Conclusion

The socio-psychological indications of the nonstudents' significant nonconformist, esthetic, creative, and intellectual dispositions, and their related vocational orientation are concomitant, in all likelihood, not only with the classic problems of adolescence and postadolesence and the contemporary difficulties regarding vocational decision-making faced by many youth today, but also with the traditional alienation from, or rejection of society that is a theme of the intellectual-esthete at least as old as Romanticism. Until rather recently, the overwhelming proportion of such alienation in American youth was expressed in private ways. The present trend is one of more visability, if not actual increment, and the formation of explicit, youth subcultures. Society's failure to reasonably provide for youths' transition and integration into responsible adulthood and to accommodate their developmental needs remains a central social concern.

The elements of social withdrawal on the part of the nonstudent membership into the subculture proper at the expense of more positive approaches, as traditionally defined, is understandable. Certainly the psychological pressure on such persons to withdraw from formal education, an environment permeated with conflicting pressure on the creative, nonconforming personality to assume a stance of self-denial, routinized behavior, and competitive achievement within irrelevant, rigidified subject areas, is fairly inevitable regardless of basic intellectual ability. In general, such individuals cannot easily satisfy their needs within the academic setting as it is often presently structured. Although it is true that certain such individuals traditionally have found the possibility of fulfillment outside academia, in all likelihood most do not--and they represent a potential loss to society.

The occupational interests, or dispositions, of the subjects of this paper are a function of their psychological needs and their strivings to develop personally acceptable self-concepts. They have high esthetically creative interests and presently untapped ability (although of unknown level), but they are denied entry into such self-expressive vocational positions. The products and efforts of the creative arts in general are not easily or happily marketable in our society. Furthermore, the area is highly competitive. Nonstudent alienation, and dropping out not only from school but from the normative structure of society, is a reflection, perhaps, of the cognizance of the pressure to make vocational decisions and the realization that restriction of possible achievement is imminent.

Higher education and society have an obligation to help dropouts--especially potentially creative individuals--avoid vocational bankruptcy. The continuing challenge is to find ways to accommodate such individuals who differ from the more conforming types of youth.

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RESIDENTIAL COLLEGES IN A LARGE UNIVERSITY

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Resident colleges are hardly a new phenomena in higher education. The Sorbonne and Oxford are two of the earliest examples of resident colleges, dating to the thirteenth century. A few American institutions have used the concept since early colonial days. Recently the idea of a body of scholars studing and living together has been adapted as a means of counteracting some of the disadvantages, while maintaining the advantages, of a large university. The resident colleges should more effectively provide an interdisciplinary focus not usually attainable in an institution organized along traditional subject matter lines.

At Michigan State University three resident colleges are now in operation. These colleges are designed specifically to attract students with certain interest patterns. Justin Morrill College, now in its third year, enrolls over 700 students in a liberal arts curriculum emphasizing languages and international relations. Lyman Briggs College offers a liberal education emphasizing science and mathematics. James Madison College offers a broad orientation to the social sciences. Briggs and Madison Colleges are in their first year of operation, each enrolling just over 200 students.

Each of the residential colleges is housed in a coeduational living-learning hall incorporating living, dining, and recreational facilities, and offices for administrators, counselors, and instructors. The physical arrangements are intended to facilitate interaction among students, faculty, and staff of each college, rather than to isolate the college from the university. All of the residential colleges have classrooms in their halls. Briggs and Madison Colleges are housed in facilities which were designed with classrooms and laboratories; these halls were constructed in 1961 and 1965 respectively. The halls in which Morrill College is housed were constructed in 1947. Meeting rooms and general purpose rooms were converted to classrooms. In addition, four classrooms in adjacent Baker Hall are used by Morrill College. None of the three colleges has rooms in their halls large enough for an all-college convocation. In each case, however, an auditorium or kiva of sufficient size is available within one or two blocks.

Science-oriented Briggs College has one laboratory at the present time and will acquire several more next year. The biological science laboratory now in operation has twelve individual study stations equipped with slide projectors, tape recorders. microscopes, and other equipment. Written manuals aid students in utilizing equipment to carry out an experiment.

Any new educational venture is predicated on the assumption that there is a group of students who can be served better by the new program than by present programs. One might expect that each of the three residential colleges would attrack students with distinctive attitudes and abilities. To plan for the continuance and improvement of residential college programs, it is essential that one be aware of the aptitudes and attitudes of students who enroll in these colleges.

At Michigan State University all new freshmen and transfer students are required to take a battery of orientation tests. The purpose of the tests is to give the student and his advisor a better picture of the student's aptitudes with

86/87

respect to the norm group, namely, other MSU freshmen. The battery includes locally constructed English and reading tests and a mathematics test. The English test incloves mastery of language conventions while the reading test measures a student's ability to interpret and comprehend materials typical of those he will encounter as a freshman. These tests are also used as screening devices to select students for advanced placement or for remedial courses. In addition to the locally constructed tests, the College Qualification Test is administered. The CQT provides a verbal score, an information score, a numerical score, and a total score.

With respect to tested aptitude, the students of science-oriented Briggs College attained the highest median on all tests but one--the verbal subtest of the CQT. They were far superior on the total score of the CQT with a median of 160 as compared to medians of 141 for both Madison and Morrill Colleges. The only groups in the University attaining CQT total score medians higher than that for Briggs College were the biochemists and physicists. Students of language-oriented Morrill College attained medians on the English and reading tests which were higher than the all-freshmen medians. These students were especially outstanding on the verbal subtest of the CQT. Their information subtest median was average, however, and their numerical subtest median was slightly below the median for all freshmen. The social scientists of Madison College attained a collective test profile somewhat superior to students in general except for their lower than average median on the numerical subtest of the CQT.

Before we can attempt to meet the students' needs, we must know what expectations they bring with them. To this end, the Student Inventory, developed by I. J. Lehmann, Gwendolyn Norrell, and A. E. Juola, was administered to all freshmen during the first few days of the fall term, 1967. Students enrolled in the residential colleges were asked to indicate what conditions they hoped to find. Most of the students in Morrill College (three-fourths of the men, two-thirds of the women) expected more personal freedom, while six out of ten men and just over half of the women of Madison and Briggs Colleges expected more personal freedom. Almost all of the residential college enrollees expected closer contact with the faculty and a greater amount of individual attention. Many of the residential college students expected a more tolerant faculty; in fact, most of the men enrolled in Madison and Morrill Colleges expected such a faculty. Over three-fourths of the Briggs and Morrill students expected broader training. About half of the Madison and Briggs students indicated that they chose to enroll in a residential college because there should be more specialized training. Few of the students expected less competition in their residential college.

Residential college students held many attitudes differing from those of students in other colleges. Although most students indicated that they desire a broad education, an even greater proportion of residential college students indicated this desire. Fewer men and women of Morrill College indicated an interest in college as a means of preparing for a vocation or profession. Furthermore, fewer Morrill College men indicated that pleasing their parents was an important reason for attending college. When given a choice between no freedom and complete freedom in choosing subjects of study and areas of interest, more Morrill students chose complete freedom than did students of any other college. A greater proportion of residential college students preferred a predominance of independent reading, writing, and research rather than a predominance of classwork, class assignments, regular examination, and so on.

Residential college students indicated a different pattern of interest in activities. They were less interested in school-spirit activities such as home-coming. More Morrill College students indicated an interest in actively participating in literary, oratorical, or dramatic activities. Fewer Briggs College students were interested in pledging a fraternity or sorority. Far more men and women of Madison College were interested in actively participating in both student government and traditional political organizations and becoming actively involved in political issues and affairs. A majority of the students in all colleges considered themselves to be political independents. A small proportion (but greater than in other colleges) indicated an interest in actively participating in contemporary political organizations such as United Students.

The students were asked to classify their "personal philosophy" according to the following categories:

A. Commitment to particular fields of study and attendance at college primarily to obtain training for careers in their chosen fields. (Occupational)

B. Attachment of greatest importance to interest in ideas, pursuit of knowledge, and cultivation of the intellect. (Intellectual)

C. Emphasis on the importance of the extracurricular aspects of college life. (Social)

D. Emphasis on individualistic interest and styles, concern for personal identity and, often, contempt for many aspects or organized society. (Individualistic)

These categories are adaptations of the student typologies originally presented by Clark and Trow (1966).

The students of Morrill College were most distinctive in their self-classification. Fewer of them felt they held occupational or social philosophies. More of them felt they were intellectually oriented, and a considerable proportion (three times as many as the average for other colleges) classified themselves as individualistic. When asked what kind of person they would like to be, Morrill students shifted away from occupational and social orientations toward an intellectual orientation.

The students of Briggs College were similar to Morrill College students in that, compared to nonresidential colleges, fewer of them considered themselves to be occupationally or socially oriented. A greater proportion than of any other college considered themselves to be most accurately described by the intellectual statement of philosophy. When indicating what kind of person they would like to be, fewer Briggs students selected a social orientation and more of them selected the individualistic orientation.

Of all residential colleges, Madison College was most similar to the average of all nonresidential colleges in the proportion of students electing each philosophy as a most accurate description of themselves. Nevertheless, fewer Madison students chose the social orientation as most descriptive of themselves, and more of them chose the intellectual orientation. Ideally, fewer Madison College students would like to be occupationally oriented, and more of them would like to be intellectually oriented.

As indicated above, we have a great deal of information about the aptitudes, attitudes, and interests of the students who have enrolled in the residential colleges. However, the future of the residential colleges will depend on how well the effects of their programs upon the achievement and attitudes of their students can be documented. Expressed in terms of Menne's (1967) paradigm, the goal is to assess the results of manipulating the environment by establishing residential colleges With this task in mind, a Residential College Research Committee, chaired by the Director of Institutional Research, was established. The Dean of each residential college and his Director of Research are members of the Committee. Other members are representatives of service agencies such as the Office of Evaluation Services, the Educational Development Program, and the Learning Service. The Committee developed an instrument to allow students in the residential colleges an opportunity to present their views and comments on the strengths and weaknesses of the programs. From this preliminary step, more specific types of evaluation may develop. The Committee also plans to administer the College and University Environment Scale (CUES) during the spring term, 1968. By then, the students will have had time to develop some definite ideas about the success of the programs. The use of an instrument such as CUES has the advantage of having available much normative data both at our institution and from national studies (Pace, 1963). Another instrument which might help to describe the residential college students' interactions with their environment is the Transactional Analysis of Personality and Environment (TAPE). TAPE is an application of the semantic differential technique to the assessment of student satisfaction with the environment (Pervin, 1967, 1968).

The picture we have, then, is one of residential college students of superior aptitude, many of whom considered themselves committed to scholarly pursuits. Many others felt a need to become more intellectually oriented. This climate would seem an ideal one in which to foster the major objectives of the residential colleges--namely, to encourage scholarly activity by bringing together small communities of like-minded students and to promote closer contact between and among students and faculty.

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ENVIRONMENTAL ASSESSMENT OF AN INNOVATIVE CLUSTER COLLEGE

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A new kind of college has emerged on the scene of American higher education during this decade--the cluster college A cluster college is a small, semi-autonomous school which is established on the campus of a larger university. Such a school is said to have many advantages over both the small liberal arts college and the gigantic university First, because it is by definition small, it can create a closer community, provide more personalized instruction, and create warmer student-faculty relations than is the case in the larger school. Second, by establishing a series of small colleges on its periphery, any existing school can admit larger numbers of students without destroying the human and educational values associated with small size. Also, because it is a new institution free from the yoke of tradition, the cluster college is able to experiment with new philosophies or methods of education. The cluster college being small, this experimentation can be performed on a limited scale which most universities can afford. Fourth, since educational innovation may be a prime function of the new school, it may provoke academic reforms in the rest of the university. Fifth, such a school promises to be more economical and to have greater intellectual and cultural resources than would be the case in a completely independent college. Finally, a university composed of a series of separate colleges offers the structured diversity and the alternative programs which are needed to cope with the individual differences of ever greater numbers of students. Such are some of the reasons why the cluster-college concept is one of the most promising innovations to emerge during the era of rapid change in American higher education.

A survey of these cluster colleges indicates that some appear to conceive of their mission as primarily social. That is, they attempt to correct the social and personal malaise of students who are forced to reside in larger, more impersonal, and more tightly bureaucratic institutions. These schools make little or no attempt to modify the traditional academic structure under which students work. Other of the cluster colleges are forging new academic arrangements as well as attempting to solve some of those social problems. Whatever their aims, it is necessary to determine the consequences of these new forms of educational organization.

The main purpose of this paper is to present some of the results of an evaluation study of one cluster college which attempts to make significant academic as well as social innovations. Data has been gathered about student perceptions of characteristics of the school, and evidence concerning the two following questions will be presented. First, have the academic and social innovations collectively led to the personalized, intellectually challenging environment desired? And, does the cluster college contain a different learning environment than that found in the rest of the university?

Some background on the school is in order. Old College (as it will be known hereafter) is a private, church-related, relatively small school enrolling about 2200 undergraduates and 350 graduates. About three-fourths of the undergraduates are enrolled in the core liberal arts college with the rest scattered throughout professional schools of education, engineering, music, and pharmacy. Old College operates according to traditional academic structures such as a semester calendar, the A-F grading system, 124 units, a major field and some typical breath courses required for graduation. It is a sociable school with a wide range of extracurricular activities, fraternities and sororities, and intercollegiate athletics.

In 1962 New College was opened, the first of a series of cluster colleges planned on the periphery of Old College. A second cluster college was opened in 1963 and a third in 1967. Each of these schools expects to have a maximum of 250 students and about 25 faculty members with each school having its own unique program.

New College has attempted to create a personalized intellectual environment in which students might both learn and grow more effectively than in most colleges. It aims to liberalize the minds of students by providing a general education within a thoroughly innovative academic structure. To realize these aims New College has adopted an academic year of three 12 to 13 week terms; has allowed students to take only three courses per term so as not to dissipate their energies among too many courses; and has resolved to award a bachelor of arts degree after only three years of study. It attempts to correct for the proliferation of specialized courses, the resulting fragmentation of knowledge, and the imbalance in any student's program by requiring students to take a heavily prescribed core curriculum containing a balance of work in mathematics and natural sciences, social science, and the humanities. It attempts to correct for a restrictive curriculum by allowing all students to take four courses in independent study examining any subject matter they desire with one or more faculty members of their own choosing. Personalized instruction is achieved by making all classes small enough that they can be conducted as seminars if the professor desires. New College has abandoned letter grades and has adopted a pass-fail system supplemented by a written letter from a teacher to each of his students. Finally, it has attempted to join the social and intellectual lives of students by creating a living and learning environment whereby faculty and students are brought together in a number of formal and informal ways outside class.

An empirical study has been undertaken to determine the consequences of these innovations. A battery of questionnaires was administered to all the students at New College, and 139 or 91 percent completed the questionnaires. Similar information was obtained from a nonrandom sample of 97 students from Old College. Although nonrandom, the Old College sample is drawn from all major segments of that school, i.e., all classes, schools, levels of achievement, and living groups. Two of the instruments were the College Characteristics Index (CCI) and the College and University Environment Scales (CUES), two widely used and standardized measures of college environments. Previous study with these instruments (Stern, 1962; Pace, 1963) indicates that a random sample is not necessary to obtain a valid description of the campus as a whole.

The CCI contains 300 statements of various aspects of college life, and the respondent is asked to indicate whether each characteristic is generally a true or false description of his school. It has 30 scales, each measured by 10 items which have been factor analyzed. Eleven first order factors and two second order

Table 1.
COLLEGE CHARACTERISTICS INDEX FACTORS: STANDARD SCORE MEANS AND PERCENTILE RANKS

		New College:		Old College:	
		Standard Score	Percentile Score	Standard Score	Percentile Score
Factors:					
I.	Intellectual Climate:	3.01	93	-2.70*	9
-10.	Work-Play	.86	66	-2.23*	12
-11.	Non-Vocational Climate	4.03	98	- .74*	35
1.	Aspiration Level	3.46	96	-2.96*	7
2.	Intellectual Climate	2.57	90	-2.17*	14
3.	Student Dignity	3.11	94	-2.66*	9
4.	Academic Climate	.11	52	-2.89*	8
5.	Academic Achievement	2.42	89	-3.32*	5
6.	Self-Expression	3.58	96	-3.59*	4
II.	Non-Intellectual Climate:	-3.72	3	.50*	59
6.	Self-Expression	3.58	96	-3.59*	4
7.	Group Life	-1.50	23	- .29*	44
8.	Academic Organization	-5.51	0	.07*	51
9.	Social Form	-3.23	1	1.06*	70
10.	Play-Work	- .86	34	2.23*	86
11.	Vocational Climate	-4.03	2	.74*	64

Note: The standard score scale has a mean of 0 and a standard deviation of 2. The norms are based upon results of 1,993 juniors and seniors in 32 colleges.

*Statistically significant difference at the .01 level of confidence.

factors have been derived from this analysis (Stern, 1963a); the two second order factors, called the Intellectual Climate and the Non-Intellectual Climate, represent the best summary of the questionnaire data. Past research (Stern, 1962; 1963b) has shown the Intellectual Climate measure to be associated with a number of traditional criteria of academic success such as the rate of graduates receiving the Ph.D., rate of production of scholars, and College Board scores. As can be seen in Table 1, New College scores at the 93rd percentile of the normative distribution on the Intellectual Climate factor, and Old College ranks at the 9th. On the Non-Intellectual Climate factor New College is at the 3rd percentile, and Old College is at the 60th. On both of these general factors as well as on each of the 11 different sub-factors of these scales the two schools differ significantly beyond the .01 level of confidence.

CUES contains 150 items taken directly from the CCI, but this instrument contains five different scales, each measured by 30 items. These data are based on a somewhat different normative group than the CCI. Again it is instructive to compare the samples on the five different scales. On the Scholarship scale, which measures the press toward serious intellectual investigation, New College scores at the 96th percentile while Old College is at the 12th. On Awareness, measuring pressures toward personal, poetic, and political interests and toward reflection, the cluster college was at the 95th and the traditional school at the 9th percentiles. On Community they were at 69 and 37, Propriety at 23 and 18, and Practicality at 5 and 26, respectively.

It would be foolhardy to presume to make an exhaustive and final evaluation of any college at any time; it would be very foolish to pretend to make such an assessment of a school based on evidence gathered as it was preparing to graduate only its second class. Nonetheless, some empirical answers can be given to the two central questions of this essay. First, taking these data as a whole, it can be concluded that the various innovations thus far generally have been successful in creating the kind of environment desired by the New College planners--one which is perceived by students to be both intellectually stimulating and yet personalized. In fact, these data as well as additional data dealing with student personality needs, subcultural orientation, and academic achievement coalesce to indicate that this particular cluster college has both environmental and student characteristics which are similar to what are regarded as the very best liberal arts colleges in the country. Indeed, it is difficult to imagine how the school could conceivably have demonstrated more success on any of these measures. Second, it is evident that the cluster college contains a very different educational climate than does the larger institution; this is true even if one makes a generous allowance for the nonrandom sample at Old College. Indeed, it is unlikely that any two schools on any campus in the country, both purporting to advance similar general purposes, are so dissimilar as New College and Old College.

A number of intriguing educational implications follow from even this cursory review of environmental data at this one university. First, since the cluster college looks very much like the schools identified by previous studies as elite liberal arts colleges, its several academic innovations must be taken as serious alternatives to the conventional structures. To be sure, it is impossible to conclude from this single instance that any one or all of the innovations are better than the traditional academic arrangements. However, this case study demonstrates that these academic innovations can work to create, as far as can be determined at this time, a quality liberal arts college.

An experimental college is generally held to be one in which new ideas are tried out on a limited scale to determine how effectively they work; the successful ideas are then applied in other educational settings where they have not been tried previously. If this concept of an experimental college is valid, then the experience of even this single small school with its academic innovations is highly significant. All of the objective evidence thus far gathered indicates that a liberal arts college can provide a stimulating learning environment by using academic procedures very different from those commonly found throughout American higher education. New College has demonstrated that a liberating college career can be as short as three years; that students can become deeply engrossed in studying only three courses at once; that all students can benefit by freedom from regular courses and permission to pursue independent study; that seminars can move the students and faculty out of their stereotyped academic roles and lead them to honestly think together; that there is a workable alternative to the usual academic grading game; and that by bringing students and faculty together in a living and learning environment they can view each other more honestly and more charitably. Of course, it is impossible to know how much each of these and other parts of the New College program have been responsible for the generally favorable results obtained thus far, and of course, it is impossible to know how much transfer value each of these innovations has to other schools. But with the experience of New College to rely on, other schools may now more confidently consider these and other alternatives to the conventional arrangements of undergraduate liberal arts colleges.

Moreover, there is a second implication. The cluster college is touted as a solution to what often is regarded as the undergraduate problem of large universities--the depersonalization of students and the separation of faculty and students. But these data show that even on what is commonly regarded as a small university, there can be some of these marks of student social and academic alienation. These data further indicate that a cluster college can create a substantially different subcultural on the campus of even a small university, a subculture which is more intellectually challenging and personally enriching than that found on the main campus. This suggests that the cluster college form of organization may have nearly as much utility for a small university as for a large one.

Still a third implication follows from the intriguing finding that this cluster college was perceived to be radically different from the more established school. New College has all the earmarks of an elite liberal arts college even though it is on the campus of Old College, which despite its many other merits, never has been recognized for its strictly academic eminence. Hence the cluster college may be a mechanism by which an institution can overcome the clutches of its past. Whatever the sins or glories of an institution's past, it can create a very different cluster college on its periphery, and thereby direct both the new and old school in a direction vastly different from its past.

Two qualifications must be made to the above discussion. Data from this study indicated that while New College students are from a similar social and cultural background, they enter with a better high school academic record than do the Old College students. And data from a longitudinal study being conducted by Joanne Floyd and Paul Heist from the Center for Research and Development in Higher Education at Berkeley indicates that they also have a different personality orientation, one which they characterize as a higher intellectual disposition. These findings suggest that the highly intellectual orientation of New College may be partly due to the fact that it attracts intellectually oriented students. If so, then the generally stimulating learning environment as shown in the results just presented may have been achieved in spite of the academic innovations rather than because of them. However, it can be argued cogently that one mark of the quality of a college is the kind of students it attracts. In this view the entering characteristics are not viewed as independent of the program but as one important component of that program. Whichever position one wants to take, it must be stated in all candor that entering students are different in the two schools.

Finally, it must be stated that while the bulk of statistical data is quite favorable, this school has not discovered an Educational Paradise. A number of unexpected consequences have occurred and have been discussed elsewhere (Gaff, 1967a, 1967b). It is enough to say here that while this cluster college seems to have solved many of the conventional educational problems with its innovations, it has created some new ones of its own. The New College community has learned by experience that innovation, however sucessful, is not a matter of solving educational problems once and for all; rather it is a matter of substituting one set of problems for another. While they have preferred to live with their own self-created problems, they are now, just like the rest of us, trying to find ways to cope with their current difficulties.

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A SIGNIFICANT PROBLEM DESERVING STUDY: THE CLUSTER COLLEGE

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The general premise of this paper is that a significant trend developing in higher education today is progressing in a largely unexamined fashion. This trend, the development of the cluster or residential colleges, is propelled by a series of premises some of which, until they are extensively studied, remain little more than feelings or forklore.

To what extent is the development of residential or cluster colleges a significant trend? If we define the term cluster college to mean any of a number of forms or arrangements (within the larger world of interinstitutional cooperation or consortiums) of coadjacent collegiate units which share facilities, staff, or program elements to a significant degree, we find that there are about 25 examples in existence or under development involving over 100 collegiate units, and more are being announced each semester as faculty planning groups conclude that the idea has merit.[1] Included in the picture to date are groups of private colleges, new public universities which are planned to develop as a cluster of colleges, and older public institutions planning to grow by adding a cluster of colleges or seeking to decentralize the curricular and cocurricular processes by undergoing organizational fission. In January, a significant portion of the meeting of the Association of American Colleges held in Minneapolis and dedicated to interinstitutional cooperation was devoted to a discussion of the problems of these emerging cluster college groups.

I am now involved in my third "clusterization" experience. I was Associate Dean of Harper College (SUNY-Binghamton) during the time plans were developed for a subcollegiate scheme. I spent 1966-67 as an American Council on Education fellow at the Claremont Colleges, and I am currently witnessing the evolution of the federated college plan at Rutgers. In March, 1967, at Claremont there was a national conference on the cluster college concept, sponsored by the Carnegie Corporation and specifically intended to examine the motives for the formation of cluster or residential colleges and to present for subsequent study problems concomitant to these motives or connected with the process of developing a group of colleges.[2]

After reviewing some two dozen cluster or residential college planning documents and histories in preparation for the Claremont conference, and as I listened to the utterances of the presidents and research directors at the conferences and the seemingly endless stream of visitors to Claremont during the year, it became somewhat clearer that there are a number of different reasons why planners think they want to form a cluster of colleges or a group of residential colleges. The more important reasons are as follows: (1) survival, (2) economy, (3) a more personal environment, (4) a greater chance for innovation, (5) remedy for isolation, and (6) seeking coeducational opportunities. Most planners were motivated by more than one factor.

It is my impression, however, that the primary motivating factors at Atlanta are (or were) items 1, and 2; at Claremont are 3, and 2; at Rutgers, at University of the Pacific and at Santa Cruz and San Diego are probably items 3, and 4. The economy and "togetherness" motivations, since they are being endorsed heavily by federal and foundation officials, will continue to become more popular especially among the large number of small private colleges throughout the country. In the Los Angeles area alone there are two instances in which small colleges have decided to pack up and move 20-40 miles to new locations seeking certain financial savings, greater educational resources, and the "critical mass" needed to mount certain programs. The survival motivation may be the most popular single factor before long.

The element in all of this that should be of interest to educational analysts and researchers, is the fact that until very recently there has been little or no research conducted on this whole process. The Claremont Colleges began clustering in the 1920's. No systematic studies on any major aspect of their program were started until 1965. A similar situation exists at most of the other sites. Many of the groups are just starting, but certain evaluative and comparative programs should be initiated at the outset if we are to learn anything about whether the feelings and folklore shared by most of the planners have been substantiated by experience. Of course, if the political situation continues to deteriorate in California, we may never learn what happened at Santa Cruz and San Diego.

Clearly, the most interesting and obvious types of studies which should be conducted with regard to the motivations of the planners of cluster groups are comparative cost studies, studies of the need for a more personal environment, and studies investigating the possibilities for curricular change. What emerged from the Claremont conference in this regard was agreement by most observers that studies about cluster and residential colleges are badly needed, and specific emphasis in studies should be given to economical operation, organizational considerations, the effect of the environment on the student, and the relationship of curriculum and the instructional process to any particular cluster or residential college scheme devised. There was disagreement, however, about which type of study should be made first. Some proposed to give priority to studies which would produce immediate answers, while others proposed long-term studies. For example, methodological, descriptive, and taxonomic studies belong to the first type, and longitudinal, impact, and input-output studies to the latter.

There have been some responses to the need for studies on these topics although perhaps not all are attributable to the 1967 Claremont conference. Dr. Clifford Stewart from Claremont reports at this conference the first results of a project supported by the Esso Foundation which was aimed at comparing costs for certain services at the Claremont Colleges with similar costs elsewhere. It was announced that a five-year study of residential colleges connected with large universities has been launched under Carnegie support at the University of Michigan Center for Research on Learning and Teaching. In addition, I believe a project has been initiated at the Center for Research and Development in Higher Education at UC-Berkeley directed toward elucudating the types of existing programs at cluster colleges, the problems they face, and their consequences.

What specific questions deserve study at and about cluster or residential college situations? The following would certainly be included in any list:

1. Perceptions of Students Seeking Admission to Cluster Colleges--If it is true that some students will thrive in a highly personal environment but be stifled in a large, annonymous one; and, if it is true that the cluster college idea (in many cases) exists to provide a more personal environment, then what kind of students seek cluster colleges? Do they know they need the environment they seek? Do admissions officers at cluster colleges seek this kind of student? Can they tell one if they see one? Does any

of this make sense or are planners in a dream world?

2. The More Personal Environment--Regardless of what kind of student is accepted to a cluster college, is it still true that all or most students will learn better or be happier in such an environment? How does the faculty feel about it? Does this environment affect a student's performance? What are the necessary ingredients for a successful environment of this type? How critical is student body size? Is living-learning enough? Must this smaller environment be within a university-like setting? Can we say anything meaningful about these things?

3. Costs and Economy--The question here resolves itself into one of three things: (a) do certain elements of the operation cost less through clustering? (b) does clustering, per se, allow particular facets to exist at all? or (c) do we just get more "service" for the same cost through clustering? The difficult questions here, as the Claremont cost study is finding, are describing the "particular facet," finding "service," and finding similar situations for comparison. Much work needs to be done here since most planners stress cutting costs.

4. Organizational Questions and The Balance of Power--Throughout the entire structure of most cluster college arrangements a series of delicate political situations exists. Of continuing concern to individual faculty members, administrators, departments, and colleges within a group is the balance between individual independence and group interdependence. Whether a group exists within a large public university or is comprised of a covey of small independent colleges in voluntary association, some accommodation must be reached between a staunch curricular and administrative prerogative for individual units and the forces seeking greater cooperation within the group. What organizational structures yield the proper balance of power without stifling the discussion and possible implementation of cooperative efforts? What elements can be cooperatively operated without impairing unit identity? What forms of federated department structures and the like assure logical curricular growth, some savings, and the maximum benefit from clustering (libraries, complementary field appointments, joint research, etc.) without invading too deeply the curricular prerogative of an individual collegiate faculty? It is here that the Rutgers experience will prove valuable to others in a year or so.

5. Innovation in Curriculum and Instruction--One of the premises which has motivated some of the planning groups is the thought that if smaller units with a great deal of autonomy can be the building blocks of a university center, then a much greater chance for the evolution of new patterns of curriculum and instruction can be assured. It will be important to see, over time, to what degree these hopes are realized. Does the cooperating group provide enough standard fare for all who need it while one or more renegade units can afford the luxury of nontraditional approaches? Does the balance of power in the group permit the adequate examination of new ideas at individual units?

Since, as many people have stated, we seem much better attuned to competition among colleges than to cooperation among them, this not only affects the degree to which lofty ideals about cooperation can be achieved, but it also severely delimits our ability to learn from attempts at cooperation. This is but one of the problems facing those who wish to study cluster colleges. Another--one that must continually be reckoned with--is the inability and unwillingness of many college administrators to cooperate with research studies. Additional data collection instruments are anathema. That is why I strongly suggest that researchers approach many of the aspects of this problem by utilizing existing data bank plans. The ACE study of entering freshmen should be a natural vehicle to approach some of the student questions noted above. A third problem facing studies of this sort is the complication introduced by pressure for admission at most institutions. In a state like New Jersey which is experiencing a near calamitous shortage of spaces at public colleges, to study why a given student seeks entrance to a Rutgers federated college is nonsense.

In summary, it is my position that despite problems which do exist, those colleges which are in a cluster environment should exchange information regularly, study their own situation as intensely as time and resources will permit, and participate in national data collection schemes so that longitudinal examination of the variables concerned may be conducted with the possibility of comparison among groups and individual colleges. Perhaps then we will have a chance to determine whether the planning groups of cluster colleges are anything more than just another faculty or administrative committee with a feeling about the future.

Footnotes

1. Examples are Claremont College, Atlanta University Center, University of the Pacific, the federated college plan at Rutgers, UC Santa Cruz, UC San Diego, and a number of large universities which have announced that they will try to regain "smallness within largeness" by developing residential colleges within the university.

2. Background materials for the conference were presented in The Cluster College Concept, H.R. Kells, 128 pp. Office of Institutional Research, The Claremont Colleges. Proceedings of the Conference were presented in the October 1967 issue of the Journal of Higher Education.

COLLEGE ROOMMATES: A STUDY OF INTERACTION AND RESULTING PERFORMANCE

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Residence halls on a university campus accommodate thousands of students each year. With occasional exceptions these rooms are designed and used to accommodate two students. What effect does this arrangement have on roommates who differ in academic potential?

The idea of pairing roommates on the basis of certain variables has a plausible ring, and previous researchers have undertaken to assess the results of such procedures. This paper briefly reviews recent studies on roommate selection and presents the results of a pilot study which sought to isolate relevant variables in assigning roommates.

Certain recent studies have been concerned with the relationships between housing arrangements and academic performance. Elton and Bate (1966), who studied roommate pairs enrolled in similar academic programs with roommate pairs enrolled in different academic programs, found that housing students according to similarity of major did not influence first semester college achievement. The first semester grade point average of a student did not predict the first semester grade point average of his roommate. This finding was true both for roommates in similar academic programs and for roommates in different academic programs.

DeCoster (1966) found that high-ability students living in close proximity to each other had a higher grade point average than high-ability students randomly assigned throughout dormitories. High-ability students, DeCoster also found, seemed to affect negatively the grade point average and withdrawal rate of comparatively lower-ability students living in the same residence unit. Although not statistically significant, high-ability students living in close proximity to each other had a lower withdrawal rate than high-ability students who were randomly assigned.

Crew and Gilblette (1966) investigated freshman performance in required courses. They compared the academic performance of roommates who were enrolled in the same required course with that of the general freshman population and attempted to show that grade patterns for roommates would differ among various dormitories with differences being associated with the larger peer group rather than the proximity of roommates. This was not substantiated. They also attemped to show that in view of proximity, roommates who were enrolled in the same required course would achieve higher grades than the general freshman population. This hypothesis was substantiated in one out of five courses.

Nasatir (1963) investigated failures in relation to the academic orientation of the student, the academic orientation of the student's residence hall, and the individual's level of integration. Students responding affirmatively to the statement that "the most important reason for attending college is to obtain a basic general education and appreciation of ideas," were considered to be academically oriented.

To determine the academic orientation of the residence hall, six dormitories were dichotomized into those above and below the mean of the distribution proportions for group members choosing the academic response. To determine level of integration, students were asked what proportion of their time they spent in the company of other members of their residence hall. Those who spent more than half of their time with other members were considered to be integrated into their residence hall. Nasatir found the following: for the integrated students, the academic individuals in the academic residence halls had a failure rate of 0 percent; the nonacademic individuals in the academic halls, 16 percent; the academic individuals in the nonacademic halls, 19 percent; and the nonacademic individuals in the nonacademic halls, 7 percent. For the nonintegrated individuals, the academic individuals in an academic hall had a failure rate of 11 percent; nonacademic individuals in the academic halls, 30 percent; academic individuals in nonacademic halls, 20 percent; and the nonacademic individuals in nonacademic halls, 17 percent. In general, the failure rate ranged about ten percentage points higher for the nonintegrated students in each category. Also, the lowest failure rates within each level of integration were for those who were in a hall corresponding to their own academic orientation; the highest failures were among those who were not so assigned.

Hall and Willerman (1963) hypothesized that students living with high-ability roommates would obtain better grades than matched students (on academic ability) living with low-ability roommates. This hypothesis was not confirmed. However, students experimentally assigned to high-ability roommates, when compared to matched students assigned to low-ability roommates, perceived their roommates as setting a better example in study, providing more encouragement and praise for study, being more desirable as roommates and more stimulating, and proving less of a distraction.

Morishima, Bell, and Hodgson (1964) studied the effects of residence hall groupings on the basis of academic majors. They compared these groupings with control groupings and found no significant differences on grade point average, disciplinary action, or change of major.

The purpose of this pilot study was to investigate the relationships with grade point average and withdrawal rate according to the academic ability of each roommate, the amount of association between roommates, and whether they requested each other as roommates. Since men and women are divided by residence halls, the sex of the subjects became another variable. The pilot study was designed to describe how these variables interact with each other so that in a future experiment these variables could be used as the basis for assigning students to the same residence areas.

Procedure

In the fall quarter of 1966, the housing office at the University of Tennessee made residence hall assignments according to their usual policy, that is, at random unless requested otherwise by the student. Since previous experience indicated there would be a large number of roommate changes during the first month following registration, about a month after registration all entering freshmen, living together as roommate pairs in nine residence halls, were identified. There were 1468 students or 734 pairs in this category. Both men and women were included.

This delay in identifying subjects was due to the fact that to investigate the effects of one roommate on the other it was necessary for the roommates to live together for a reasonable length of time. Once the roommate pairs had been identified, a student who subsequently changed his roommate was dropped from the study.

An ability score was obtained for each student by computing a standard score giving equal weight to high school grade point average and to American College Testing standard composite score. The 1468 students were ranked according to their ability score, and those students with an ability score in the top 27 percent of the distribution were designated high-ability students, those in the bottom 27 percent became low-ability, and those in the middle 46 percent were called medium-ability students. Thus, each student received one of the following designations: high-ability, medium-ability, or low-ability.

Based on the ability grouping used, nine possible combinations of roommate pairs could be identified:

G1	H(H)	High-ability student living with high-ability student
G2	H(M)	High-ability student living with medium-ability student
G3	H(L)	High-ability student living with low-ability student
G4	M(H)	Medium-ability student living with high-ability student
G5	M(M)	Medium-ability student living with medium-ability student
G6	M(L)	Medium-ability student living with low-ability student
G7	L(H)	Low-ability student living with high-ability student
G8	L(M)	Low-ability student living with medium-ability student
G9	L(L)	Low-ability student living with low-ability student

In order to obtain an association score, each student received a questionnaire to be completed voluntarily. The researchers mailed these questionnaires near the end of each of the fall, winter, and spring quarters. Only those students who continued to be roommates received the questionnaire; students who changed roommates were not sent a questionnaire.

The questionnaire response allowed each student to be designated as a high-association student (Ah) or a low-association student (Al). After determining the median association score for the 1468 students, those above the median were classified high-association students, while those below the median were classified low-association students.

Students who had requested and those who had not requested a roommate were then identified. Finally, the study called for collecting grade point data on all students for each quarter of attendance. A student was classified as a withdrawal if he left the University anytime during the 1966-1967 school year or was academically dismissed at the end of the spring quarter, 1967.

Results

Withdrawal rates seemed much more affected by the variables studied than grade point averages. Perhaps one of the most significant aspects of the study was the finding that all the variables, that is ability, roommate's ability, association with roommate, requested preference for a roommate, and sex, needed to be considered simultaneously. The following summarizes the comparisons that turned out to be significant and salient with regard to withdrawal rate and grade point average.

1. Men who requested a roommate withdrew less and had a higher grade point average than those who did not make a request.

2. For women who had a low-association score with their roommates, those requesting roommates withdrew more frequently than those who were nonrequesters.

3. For men with high and low-ability scores, those with roommates in a different category than their own withdrew more than roommates with the same ability.

4. For high-ability men with low-ability roommates, those with high-association withdrew more than those with low-association.

5. For women with high-ability roommates, those with low-association withdrew more than those with high-association.

6. For women who requested roommates who happened to be classified as medium ability, those with low-association withdrew more than those with high-association.

7. For men who requested their roommate, those with high-association had a higher grade point average than those with low-association.

Discussion of Results

A wide difference in effects emerged when one held constant the variable on requesting or not requesting a roommate. Men who requested their roommate seemed to withdraw less than men who did not make a selection. The opposite finding occurred for women. Previous studies apparently do not treat this phenomenon.

Since several researchers have studied the grouping of students in residence halls, it was possible to obtain some insight into the present results. DeCoster (1966) pointed out that high-ability students placed with similar type students were better off with respect to grade point average and withdrawal rates. Furthermore, high-ability students when living near low-ability students produced a negative effect. The study at The University of Tennessee supported DeCoster's finding, if only men and their withdrawal rates are concerned. Schroeder and Sledge (1967) found that academic success was best predicted by academic ability. The research agreed with this idea, at least in part, but suggested other variables which add considerably to the predictive process.

Nasatir (1963) used a concept called degree of integration somewhat similar to the use of the term association in this study. He found students with a high degree of integration withdrew much less than those students with a low degree of integration. In this study women with high-association withdrew less than women with low-association. Such a generalization, however, did not hold for men.

Nasatir's concept of integration was somewhat broader than the one used in this study. The term integration meant the individual's social participation with the whole residence hall rather than just his roommate. It was found in the study at Tennessee that in the case of a student who did not request a roommate the chances were three out of four that he would buddy with a person other than his roommate. It appears reasonable to suggest, therefore, that future research might consider larger groups or clusters in residence halls rather than studying only roommates.

Nasatir also used another effective variable--academic orientation of individual and of residence hall. While this study did not include such a variable, it could be of interest in future studies. This study suggests that in future research in this area students should be selected on the basis of about five variables in order to be assigned a residence hall living group. There is too much interaction among the variables to assign roommates according to one or two variables and still obtain any meaningful information. Such a design would prove more complicated but it appears necessary.

Summary and Conclusions

Freshmen students living in residence halls at the University of Tennessee during the 1966-67 school year were studied. This study, using 734 pairs of freshmen, sought to identify variables which would be relevant to the slection of roommates. Students were classified according to their academic ability, their roommate's ability, the degree to which they associated with their roommate, whether or not they requested their roommate, and their sex. Their college grade point average was obtained each quarter, together with their continued matriculation or withdrawal from college. Results indicated that withdrawal rate was affected more by the variables than grade point average. Furthermore, all the classification variables were needed, interacting with each other to determine an accurate withdrawal rate. It is reasonable to suggest that in future studies of the influences of residence hall living, groups be studied as well as roommates.

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THE REALITY OF INSTITUTIONAL CONSTRAINTS UPON UNBIASED INTERVIEWEE SELECTION

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The fate of anyone engaged in collecting data for research is, in part, determined by: (1) the belief or nonbelief that the subject under study deserves investigation, (2) the freedom of access to those "respondents" whom the researcher wishes to question, and (3) the position accorded the researcher or institutional research in a particular organization. It is our intent to examine the second variable in greater detail using our own experience as a point of departure.

A Case in Point

During the 1966-67 academic year, we were engaged in a study of junior college faculty in New York State. One phase of the investigation necessitated interviews at 18 preselected colleges. Excellent cooperation was given by the president's office at each of the institutions. An introductory letter to each president explained the purpose of our visit and listed in general the kinds of questions we would be asking the faculty. Our intent was to find out how newly employed instructors came to consider the junior college as a place of work, the means they found to be successful in finding an opening, and if they had received inside help in locating their present position. One can immediately see that we were concerned with more than just the details of occupational entry. The interviewee would essentially be revealing something about the professional climate of his college, the nature of its occupational welcome, and the initiation patterns used by the employing organization.

Arranging Interviews

The faculty to be interviewed were selected at the discretion of the administrative officer of each college. It was requested that at least three faculty be available for interview purposes, and that they be full-time teachers hired since the academic year 1965-66. As far as we could ascertain, no faculty member refused.

We have no evidence that any of the selected institutions were apprehensive about our motives, but we were not able to choose as freely as we would have liked the particular faculty to be interviewed. This is not to imply, however, that any conscious or premediated selection of faculty respondents was made by the administrative officers of the colleges. Faculty availablilty on a particular day, at a particular time, was certainly a factor. Theoretically, while an institution has X number of faculty who meet the criteria determined by the investigator, the actual pool of possible interviewees is diminished by the compatibility of the interview schedule with the instructors' teaching schedule for any one period.

Although we did have a listing of the total number of new faculty at each college, it was impossible to arrange and rearrange our total schedule to accomplish a stratified sampling. This would entail faculty missing classes, and no one volunteered that this be done when other faculty were available. There was no choice but to depend upon the college to choose the respondents. Nevertheless, we wanted to find out how our respondents were selected at each institution.

We discovered that at five institutions, the president chose purposively those certain faculty according to his perception of fair selection; at five institutions, the dean chose purposively in terms of his perceptions of a fair selection; at four institutions, someone other than a chief administrator chose randomly from either a faculty listing or a catalogue; at four institutions, faculty interviewees were selected randomly after the researcher arrived.

It is interesting to reflect upon the perceptions of fairness which directed the decisions of those individuals who so carefully picked interviewees. "I wanted to be sure you didn't just talk to the liberal arts people," cautioned one. "I tried to get both males and females for you," noted another. "The people you are going to interview represent both transfer and terminal curricula," explained a third. Several individuls were chosen to be interviewed because a staff member believed that they had an especially unusual story to tell. "You'd never guess where we got him," teased one dean.

This experience--this realization of being at the mercy of both the research demands and the interpretations of those demands by individuals not accounted for in the procedure led us to consider some of the effects of person-to-person confrontations in the name of research.

Personal and Impersonal Data

Previous forum papers have amply reminded us how the position and perception of research held by individuals in an organization contributes not only to the successful completion of projects but also narrows the typology of projects pursued. James Doi has reminded us that "just as some institutions are able to tolerate certain kinds of studies which others are not, some institutions are better able than others to withstand having their 'guts' revealed to the public."[1] We have found little reference to the institutional constraints placed upon research officers--restraints which are directly related to the researcher's working with people. One notable exception is an article by Mary Corcoran on faculty members.[2]

For some kinds of research problems, it is necessary to worry people; for other kinds, it is not. We can examine student folders, computerize test records, factor variables on application forms, catagorize dossier material, and make statistics out of class records to our hearts' content. Who is going to forbid a researcher whose only threat is that he "untidies" someone's files?

It is most interesting, as we look through previous forum discussions and read of the studies reported, to see how few studies require any personal contact between investigator and that being investigated.[3] Does one need to talk to freshmen to investigate their academic characteristics or to trace the academic performance of transfer students from a junior college? Do we have to interview faculty in order to acquire information on the relationship between sources on CEEB verbal and English achievement and grades in English composition for the fall semester?

We are not denigrating the importance of these kinds of research. Rather, we are asking if the existence of fixed data makes it easy for a researcher to avoid confronting people for information. As Mary Corcoran states:

> Institutional research people feel pretty much at ease about carrying out studies of finance and of space and physical facilities . . . and very uncertain about what they should do about faculty studies. This is a touchy territory, many would say, and has best be avoided.[4]

Corcoran regards the hesitancy over faculty studies to be somewhat a function of the criticism by faculty of the performance of researchers. She notes also the relationship (perceived by faculty) existing between the institutional research offices and the administration. Institutional research is viewed by faculty as an administrative operation. This is especially evident if we agree with Stuart Grout's definition of institutional research as "research about a particular institution of higher learning by those within the institution for the express purpose of *aiding in the administration* of the institution."[5]

If it is true that some of the most interesting studies completed by IR offices go unseen and are not disseminated widely even within one institution, then it is no wonder that much of what goes on under the name of IR is--to use John Stecklein's words--mundane and rountine.[6] A desire for the visibility of some types of research is detrimental to confidentiality. How, then, are we to proceed? How are we to develop a reputation for functioning well--for handling touchy questions with sometimes touchy people? And why don't we talk about this more? Stecklein reminds us that this ability is pivotal to the professionalization of institutional research. "Institutional research, in addition to routine data collection must also develop as part of the professional perspective, a concern for more basic research devoted to a better understanding and critical evaluation of fundamental education policies. . . ."[7] How are we to make a process out of an art and move into areas which cry for investigation?

Safety Man or Change Agent?

We like to assume that if an individual is given responsibility for research, this responsibility grants him access to a variety of sources. Further, we like to believe that the researcher, as an inside man, should encounter a minimum of difficulty. But is this really so? Those who would study faculty, for example, run into a series of blocks: (1) not all faculty or administrators believe that institutional research should move beyond mere data collection; (2) not all faculty or administrators believe that institutional researchers know what they are doing; and (3) not all faculty or administrators miss the implications of the latent power for the institutional researcher in terms of policy advisement.

Developing a Hypothesis for Discussion

If our hypothesis about the comparative ease of collecting impersonal data is plausible, then we might conjecture that the types of studies currently being carried on in any office of institutional research reflect to some degree the professional age of that office. In other words, IR offices have come of age if they are able to carry out investigations which call for a high degree of person-to-person contact on sensitive issues (i.e., evaluation of faculty for one).

Final Comments

It is not enough to say that a researcher needs all kinds of data. It is quite different to declare that we have little experience in some research areas and a great deal of experience in others. Can offices of institutional research provide both administration and faculty with information relevant to some of the less touched issues? Who will develop a really effective and valid instrument or technique for the evaluation of teaching? How can we describe and communicate the polarity of attitudes about new faculty organizations developing on campuses?

When will we begin to disseminate information on the effectiveness or noneffectiveness of student and faculty participation in decision making? Who can give us the needed research on faculty promotion criteria? We who believe in the efficiency of research to guide intelligent, organizational decision making must remember that people are also subject to research.

Footnotes

1. James Doi, Summary remarks, *Proceedings of the Fourth Annual Forum of the Association for Institutional Research*, May 1964, p. 56.

2. Mary Corcoran, "The Study of Faculty Members: Some Cautionary Verses," from *Proceedings of the Sixth Annual Forum of the Association for Institutional Research*, May 1966, pp. 65-70.

3. L. E. Torrence reports the studies conducted in his office of research in the *Proceedings of the Fourth Annual Forum of the Association for Institutional Research*, May 1964, p. 25.

4. Corcoran, p. 65.

5. Stuart Grout, In *Proceedings of the Fourth Annual Forum of the Association for Institutional Research*, May 1964, p. 5.

6. John E. Stecklein, President's address in *Research on Academic Input, Proceedings of the Sixth Annual Forum of the Association for Institutional Research*, May 1966, p. 12.

7. *Ibid*.

OUTPUT AS A SEGMENT OF ORGANIZATIONAL GOALS

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The goals of complex organizations represent the paradox of having a high significance to the organization but having been little studied and analyzed. According to Talcott Parsons, "primacy of orientation to the attainment of a specific goal is the defining characteristic of a social organization." (Parsons, 1960) In this sense, knowledge of goals is required for any discussion of organizational performance.

The difficulty of assessing organizational goals has placed many researchers in the position of dealing with goals as a static variable best represented by the statements found in formal organization documents. The goals of educational organizations have thus become various combinations of and emphases on teaching, research, and service. The representation of the goals of institutions of higher learning in this static and oversimplified manner is unreal for several reasons.

One reason is the size and complexity of the present educational establishment. We have come a long way from the point of having Mark Hopkins on one end of the log and a student on the other. The multiversity of today with over 30,000 students differs greatly from the small church-related college of our historic past. Even the colleges of today are fast becoming complex organizations. The public colleges of New York State range in size from 2,000 to over 9,000 students. An educational organization of these dimensions finds itself carrying out a great many activities sometimes only remotely related to the goals of teaching, research, and service.

The establishing of organizational goals can be conceptualized as a problem of defining a relationship between the organization and its environment. The environment of educational organizations is anything but static. Change seems to be the watchword of today's society. As the environment changes, it affects this interacting process and the educational organization as well. Just as we witnessed the rise of service to rural America with the land-grant movement, we may soon witness a change to provide similar service to urban America. Within this framework, we must be aware that goal appraisal is a recurrent organizational problem of great complexity.

The problem is increased with educational organizations in two ways. For an organization dealing either directly or indirectly with research and free inquiry, the academic institution is not very prone to systematically study itself. The academic community seems to adopt a protective attitude when it comes to self study. The faculty, generally of somewhat divergent views, seem to band together in a protective crouch. This is particularly relevant if the interested researcher is identified with the "administration" as so often is the case.

A second problem in academic institutions making goal appraisal difficult is the very nature of the goals themselves. Goal determination becomes incresingly difficult as the product of the organization becomes more intangible and more difficult to objectively measure. The organization that concerns itself with producing educated people finds its results evaluated by many people and institutions very often with conflicting yardsticks. Even in the field of research it is the highly unusual research report that is received well by an overwhelming majority of its audience. This state of being indicates that organizational goals are complex, dynamic entities that are difficult to capture.

Regardless of the difficulty in assessing goals for educational organizations, it is a task of paramount importance. The primary need for assessing goals lies in the area of appraisal or evaluation. A functionary requirement of evaluation is the desired end result. To determine how effective or efficient an organization is in its goal attainment process, we must know what the goals are. A directly related need of equal importance is in educational planning. For an institution to better determine where it should go in the future, it must know where it is going now.

At a recent meeting of the American Council on Education, it was said that "if the academic community is to remain creative and coherent, it must identify the goals common to all its constituents, it must select goals appropriate to each academic institution, and it must even elimate some goals." (C.B.T. Lee, 1967)

An educational planning need has particular relevance for this study. Many public colleges in the country are undergoing a transition from a normal school-teacher training institution to the broader concept of a liberal arts college. With an educational change of this significance, it is absolutely essential to examine the institutional goals.

Two primary types of information are necessary to examine organizational goals--intentions and activities. Intentions are that which the organization says it is doing and what other people believe the organization is doing. Activities represent what the organization can be observed doing. The college catalog that states an intention to provide individualized instruction, while the college increases its student-teacher ratio, presents an obvious disagreement between activities and intentions. Evidence of both kinds needs to be examined to completely determine organizational goals.

A meaningful and concise way to assess the goals of educational organizations is available through instrumentation developed by Edward Gross and Paul V. Grambsch. Their instrument presents 47 goal statements and collects a scale response to two questions. How important is each aim at this college? How important should the aim be at this college? The original instrument includes more information than the goals, but only the goal response is considered in this study.

The instrument is designed for administration to the faculty and administration of universities. The responses of these organizational participants should accurately portray both intentions and activities. The respondents are in a position to assess both intentions and activities and report the resultant. If the student-teacher ratio does not support a concept of individualized instruction, this will be reflected in the response of someone who is aware of this. The first question that comes to mind is the issue of whether administrators, with their role being closer to the power structure, present a different view of organizational goals than do faculty.

It is obvious to us within the educational establishment that description of goals is no simple matter. Goals that can be termed output goals are the most visible and thus the easiest to describe. However, if a goal is considered to be a clearly defined intention for which an activity can be observed, other categories of goals are apparent. These other kinds of goals, which can be conceptualized as adaption, management, motivation and positional goals, are necessary if the organization intends to produce output. If the organization is clearly dependent upon the attaining of a positional or a management goal for survival, it seems meaningful to consider this type of goal on the same level as an output goal.

The goal of keeping up to date and responsive, a positional goal has as much relevance for organizational survival as an output goal of producing an intellectual student. With this as a conceptual framework, Gross and Grambsch developed their list of 47 goals from the literature in higher education and the published documents of educational institutions. The instrument was then administered to over 8,000 faculty of 68 university organizations. The sample included both instructional and noninstructional faculty or administrators.

This study reports on the administration of the goal's instrument to the faculty of a New York State public college with an enrollment of just over 3,000 students. The instrument was sent to all faculty members and the response rate of 35 percent produced 113 usuable questionnaires.

Three rather basic research questions motivated the study: (1) What are and what should be the goals of public colleges as viewed by faculty? (2) Do the views of what public college goals are and should be differ between instructional and noninstructional faculty? Do the views of what public college goals are and should be differ among faculty with different years of employment at the same college?

As a by-product, the study produced answers to two questions of significance, but less importance. Are output goals considered the most important goals, and are goals of colleges really different from goals of universities?

The results of this study show that the top goal of public colleges is to provide student activities, but the top goal should be to protect academic freedom. It is an implicit criticism if the two are not the same. This is accentuated when top "is-goal" of providing student activities ranks 27th in the "should-be" group.

In fact, only one of the top five "is goals," to protect academic freedom appears in the top five "should-be goals." The conclusion to this is that the institution is doing the job of protecting academic freedom better than any other goal it should be carrying out.

The instructional faculty report that the top goal is career preparation, while the top goal should be to protect academic freedom. The noninstructional faculty places career preparation as the 4th "is goal" and provide student activities as the top "is goal." This undoubtedly accounts for some of the overall evaluation of the top "is goal" as providing student activities. However, the teaching faculty ranks provide student activities as the second "is goal" which is still well above the "should-be" rank. The top "should-be goal" for noninstructional faculty is to protect academic freedom, which agrees with the instructional faculty.

Inspection seems to indicate that there is considerable agreement between instructional and noninstructional faculty. In the "is" category, the same 4 goals appear somewhere in the top 5 ranks for both groups. The same is true in the "should-be" category with 4 different goals.

One surprise in the "should-be" category is the number five ranking of the goal to accept graduate students only by noninstructional faculty. This would be a major role change for a New York public college, and one which is not anticipated. It is significant that the administrative component of the organization feels that accepting graduate students only should be an important goal.

Spearman rank order coefficients calculated between faculty and administration are .82 for the "is" category and .60 for the "should-be" category. Less conflict is apparent in the assessment of what the goals actually are, than what the goals should be. While faculty and administrators can sometimes agree on what is the situation, they do not seem to agree on what to do about it.

The third research question was examined by dividing the sample into 3 groups. One group of faculty had only been employed at the college for one year, one group for two to five years, and the third group had been employed at the college 6 years or more.

For purposes of determining if length of employment relates to perception of organizational goals, the youngest and oldest groups are analyzed. The youngest group ranked "provide student activities" as the top "is goal" and the oldest group ranked "protect academic freedom" as the top "is goal" with "provide student activities" as the second "is goal." The top five goals for both groups are the same goals with slightly differing ranks. The groups completely agree as to what the top 5 goals are. The emphasis on each is slightly different.

This finding is significant in terms of the immediate past of this college. As in many state colleges, a transition is taking place. The college is rapidly moving away from a narrow teacher education concept toward a broader liberal arts and science concept. The faculty with more than 6 years at the institution were hired before the main impact of this transition. A significant part of the movement is to recruit faculty appropriate for a 'liberal arts' college. In this context, it is significant that both groups agree with the top 5 goals. The agreement is not so high over the entire ranking of goals. A Spearman rank order coefficient calculated between the two groups is .66. Thus, while agreement on the most important goals exists, it is not agreement on the entire goal structure priority.

The same agreement does not hold true for the "should-be" category. The top goal of protect academic freedom is agreed to by both groups, but only 4 of the top 5 goals are mutually acceptable. The Spearman rank order coefficient is .65, only slightly less than that for the "is" category. The conclusion is that little difference exists between the "is" and "should-be" categories as to the degree of agreement or disagreement between the youngest faculty and the oldest faculty.

These findings do not support a thesis of a serious conflict between liberal arts oriented faculty or teacher training oriented faculty. It may be, however, that either no such conflict exists or that a different type of faculty is not really being recruited.

As an answer to the first of the secondary research questions, output goals are not generally rated as the most important goal categories. Only the oldest faculty ranked output goals as the top "is goal" category. The other groups either ranked it last or 4th. The overall ranking of output goals was 5th in the "is" category.

The oldest faculty, however, ranked output goals 4th in the "should-be" category. Complete agreement among all groups existed as far as ranking output goals 4th in the "should-be" category. Not only do faculty rank output goals at the bottom of the priority rank, but they are relatively satisified that is where output goals belong.

The top "is goal" according to university faculty is to protect academic freedom. College faculty also rate this goal highly. This is about the only area of agreement. Computation of a Spearman rank order coefficient between goals ranked by college faculty and university faculty produces a surprising -.46. There is a negative correlation between the goals of colleges and the goals of universities. There is a real difference between goals of colleges and universities.

Examination of the relationship in the "should-be" category shows that a relatively high relationship exists between colleges and universities as to what the goals of these two organizations should be. This suggests that the university represents the model for members of other types of educational organizations. This may well be a function of the fact that most members of college faculty are products of university communities. The socialization process of universities on potential faculty members is very successful.

This presents obvious problems in an institution which articulates an educational mission different from that articulated by a university institution. If the faculty of a college feel the goals should be the same as a university, a real problem exists if a different mission is desired. More study is needed on this issue.

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THE RELUCTANT PLANNER:
THE ROLE OF FACULTY IN INSTITUTIONAL PLANNING

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Since World War II and the post-Sputnik decade, American society has made a notable commitment to universal higher education. Vastly expanded enrollments, the rapid rate of social and technological change, and the heavy demands upon federal, state, and local resources have created monumental pressures on educators, state and federal officials, and the general public to become more seriously concerned about the future direction of higher education. Already forty-three states have developed some form of statewide coordination and planning to cope with these pressures. Such statewide activities are creating substantial pressures for institutional planning, which, in turn, raises questions about how, to what extent, and for what purposes faculty might participate in local planning.

In this paper, we intend to examine the role of faculty in institutional planning. Our objectives are, first, to develop a paradigm for institutional planning which provides some clarification as to what faculty participation in planning might include from a theoretical perspective; second, to present and discuss data which describe how faculty are presently participating in planning at a sample of institutions; third, to draw comparisons between behavior suggested by the paradigm and the actual participation of faculty in planning; and, finally, to present an interpretation of the observed similarities and dissimilarities between suggested and actual patterns of participation.

The articles which discuss the role of faculty in college and university governance, in the main, are based on the opinions, beliefs, and convictions of individuals or the "official positions" of professional associations concerned with the rights and responsibilities of faculty.[1] These judgments, however, are difficult to assess since no information is given to suggest the underlying assumptions or premises about university or college organization from which they are derived. A similar evaluation applies to the few articles written about the role of faculty in institutional planning itself. The content of these articles goes little beyond broad assertions that the faculty "ought to participate" and "ought to be consulted" in planning. Unfortunately, however, no clear definition is given regarding the activities referred to as planning.

One of the best statements related to the role of faculty in planning appears in the Winter, 1966 issue of the AAUP Bulletin.[2] In the "Statement on Government of Colleges and Universities," issued jointly by AAUP, ACE, and AGBUC, there are several themes which are relevant for our purposes. First, the authors assert that an effective and workable relationship between institutions, on the one hand, and legislative and executive governmental authorities, on the other, requires that the academic institution have a unified view of itself. Second, a multiplicity of factors and dimensions which permeate the several tasks performed by institutions necessitates the full opportunity for joint planning among governing boards, administration, faculty, students, and other. Third, certain issues require the initiating capacity and decision-making responsibility of all institutional participants, and differences in the weight each voice has should be set by reference to the responsibility each party has for the issue or matter at hand. Fourth, long-range planning, which is one of the most important parts of institutional responsibility, should be a "central and continuing concern in the academic community." Fifth, the president is the chief planning officer of an institution and has a special obligation to innovate and initiate. And finally, the faculty has primary responsibility for curriculum, methods of instruction, research, faculty status, and those portions of student life which relate to the educational process.

This article and others which discuss the faculty's role in governance and planning do not provide detail about the content and processes of planning, nor suggest a theoretical rationale for faculty participation. Further, these articles are not based on empirical research about the current patterns of participation by faculty in different types of planning. To overcome some of these limitations, we begin by developing a paradigm for institutional planning.

A General Paradigm for Institutional Planning

The primary problem that all institutions face is the definition of their distinctive mission and role. A second, but very closely related problem, is the necessity to continuously and consciously review and adapt their mission to new commitments. Phillip Selznick in Leadership in Administration states that "a university led by administrators without a clear sense of values to be achieved may fail dismally while steadily growing larger and more secure."[3] Thus, quantitative expansion, such as that taking place in higher education today, need not lead to an examination of institutional mission and role. Therefore, the basic function of planning is that of defining and adapting institutional mission and role according to basic value commitments.

One of the central aspects of institutional leadership is to define basic value commitments. In contrast to other organizational settings where leadership is commonly associated with top-level administrators, a broader view is necessary in higher education. It seems more appropriate to view institutional leadership within colleges and universities as shared by faculty, students, administrators, and trustees. It is diffuse, not concentrated. Burton Clark says that authority in colleges and universities "is not as closely knit, nor as hierarchical, as in most other settings."[4] Abbott states that administration is to be defined "not as people but as the processes by which and through which objectives are defined, resources are developed and organized in pursuit of these objectives, evaluation of results is accomplished, plans are made and remade. . . .On this definition, obviously 'adminstrators' have no monopoly on 'administration'; the faculty has a vast stake and role in it."[5]

A further distinction by Selznick is appropriate to this discussion of institutional leadership and planning. He draws a dichotomy between two substantially different types of decisions; those that are critical to the institution, i.e., define its ends, design its enterprise, translate the design into reality; and those that are routine, i.e., refer to the solution of day-to-day problems that keep the organization running efficiently.[6] A review of planning in higher education reveals that the logic of efficiency predominates. Contemporary planning is preoccupied with routine decisions or logistics--physical, fiscal, demographic factors of expansion, and quantitative rather than qualitative development.[7] The paradigm which follows suggests a reorientation to planning where the making of critical decisions becomes the predominate concern. This is not to preclude the important questions and decisions concerned with efficiency or day-to-day affairs, but to place these in their proper context.

Given the premise that planning is a central feature of institutional leadership shared by all major participants, we can suggest further dimensions of a general paradigm for institutional planning. These dimensions are

1. Scope--Long-range planning includes the examination and determination of all the major policies about institutional functions and activities: the definition of mission and role, programs (research and public service) and curricula, methods and form of instruction; recruitment, selection, promotion, and general welfare; admissions criteria, academic standards, and student affairs; finances and facilities.

2. Priority--The definition of mission and role so as to identify special competencies and inadequacies is the first and most basic task of institutional planning. This includes the specification of priorities among the multiple ends of educational institutions as well as the establishment of priorities with regard to the other dimensions listed above.

3. Continuity--Planning is a continuous process of adapting to changing conditions resulting in written plans but never rigidly attached to any one plan.

4. Research--Planning is informed and highly dependent on research which takes as its foci the (several) critical questions and key issues facing the institution.

5. Participants--Faculty, students, administrators, and trustees all share responsibility for institutional planning. Each group has unique perspectives, attitudes, and types of expertise.

6. Participation--Planning involves both the initiation of and reaction to ideas where the role of initiator or reactor is played by various groups at different times. An exchange and interaction of ideas, experiences, interests, and attitudes is necessary. Participation will likely be heightened when special incentives --released time and additional resources-- are provided.

7. Structure--Planning requires a special structure since existing student, faculty, and administrative structures are geared primarily to routine, day-to-day issues and often focus on fairly limited parts of the total institution. To encourage open communication among all parties and promote an institutional perspective, some type of joint steering committee is necessary. This group would likely work in close cooperation with the existing committee structure.

8. Implementation--The planning process includes specification of a time table and the general strategy by which specific proposals will be put into action.

Some additional specification of the paradigm is necessary since our primary concern is the role of faculty in institutional planning. A clearer rationale is needed for faculty participation. This rationale might be based on the following: first, a plan must assess existing strengths and weaknesses in institutional curricula and programs; second, a plan must be sensitive to significant subject-matter developments and new approaches to teaching in the various disciplines; and third, a plan must be informed by judgments about the educational soundness and feasibility of proposed modifications or additions to curricula, programs, and methods of instruction. These important reflections, sensitivities, and judgments should emerge primarily from the faculty since they are most directly and continuously confronted with such questions, issues, and developments. It is questionable whether administrators can provide this type of expertise since they are becoming increasingly preoccupied with external pressures and issues, and thus tending to lose contact with the academic processes in their own institutions.[8]

Beyond the above rationale for faculty participation in institutional planning, we also need some specification about the roles faculty should play with regard to different aspects of this effort. Earlier it was mentioned that a distinction might be drawn between two different roles in planning--initiator and reactor. It is suggested that faculty play an initiator role in institutional planning with regard to critical issues and questions about curricula and programs, methods of instruction, support for research, the selection and promotion of faculty, standards for academic performance of students and for the granting of degrees. In contrast, there are activities and functions not so readily identified with the responsibilities of any single group and not as directly related to the central interests of faculty, e.g., institutional mission and role, standards of admission for students, aspects of student campus life related to educational processes, and fiscal and facilities items. In these areas it is suggested that the faculty play more of a reactor role in institutional planning.

What these proposals suggest about faculty participation in institutional planning is that none of the general activities and functions of colleges and universities are irrelevant to the faculty. Nevertheless, this is not to imply that all faculty are to be involved in all aspects of institutional planning. Faculty participation may take many forms and occur at different levels within an institution. Finally, to reiterate a point mentioned in the joint "Statement," the president is the chief planning officer of an institution. The faculty are advisory to him, and in the end, it is he who must assume responsibility for planning.

This paradigm provides, then, a set of general expectations about the style of planning, the process and form of participation by various institutional components, and the particular areas where faculty ought to exercise leadership based on their special skills and competencies. One might suggest that the paradigm needs more specificity and greater clarity. However, to do this would overlook the complexities of planning and the uniqueness of institutional settings. No single paradigm for institutional planning could work well in all types of institutions. Thus, the paradigm outlined above suggests rather than prescribes, sets general rather than specific expectations, and is intended to stimulate rather than dictate thinking and ideas about planning.

Procedures

The Center for Research and Development in Higher Education has recently conducted a study of statewide planning and its institutional effects in four states--California, Florida, Illinois, and New York. Although the major thrust of this study was to identify how critical decisions made outside institutions affect their mission and role, considerable data were collected through interviews and documents about institutional planning within the sample of eighty-one colleges and universities. These institutions included public and private universities, state colleges, and junior or community colleges. A purposely selected sample of faculty and administrators were interviewed on each campus using a semi-structured interview schedule which included the following items: present and past planning activities, the rationale for planning, the arrangements by which plans were or are being developed, the extent to which plans have been implemented, the basic questions or issues around which planning is organized, and the attitudes held by faculty about planning. Approximately 400 interviews were conducted with faculty and administrators at these institutions and the interviews ranged in length from one to three hours.

Findings and Interpretation

The data analysis is organized under three topics--type of planning, participation, and reasons for faculty involvement. The first two topics are used primarily to establish a context for the discussion of the faculty role in planning. Comparisons among institutions with regard to each topic are made in terms of five control variables: functional type (i.e., university, state colleges, and junior colleges), public versus private, new or changing versus older-traditional, and primary emphasis on qualitative or quantitative planning. Our fifth comparison, by states, is intended to assess the influence of the statewide network on institutional planning.

Nine dimensions are used to characterize the type of planning in the past at the eighty-one institutions studied. The dimensions are qualitative/quantitative, periodic/continuous, integrated/piecemeal, institution-wide/partial, inductive/deductive, innovative/routine, research based/based on limited data, priorities/no priorities, and motivated by internal/external pressures. At the most general level the data show that all institutions have used some form of planning in the past. This can be generally characterized in terms of the above dichotomies as quantitative, periodic, piecemeal institution-wide, deductive, routine, based on limited research, and inititated by pressures external to the institutions. There was an even split among institutions on setting or not setting priorities. It was also found that most institutions are presently developing a comprehensive plan. In a few cases this effort represents a marked shift toward greater emphasis on matters of educational policy.

Institutions classified as having qualitative planning also have a type of planning which is significantly more integrated and innovative, more likely to be institution-wide, and which reflects the establishment of priorities among educational programs and objectives. Comparisons across states suggest that planning in the New York institutions is performed on a more continuous basis. In comparison to state colleges and junior colleges, major public universities more often use an inductive approach to planning and more frequently base their planning on special research and related studies.

Contrary to what one might generally expect, we found no significant differences in the type of planning at public versus private institutions, nor at new or changing versus older-traditional institutions. For both of these comparisons an intervening variable--qualitative planning--is so distributed that anticipated differences are masked.

Three dimensions are used to characterize participation in planning. These include: use of special or existing structures; whether this structure is joint (faculty and administrators) or separate (faculty or administrators); and the amount of faculty participation in the planning effort, classified as medium-heavy or light.

The data show that planning presently underway is accomplished primarily through existing committee structures, which usually separate the planning efforts of faculty from those of administrators. Participation by faculty is light in the majority of institutions. No important changes in this pattern occur when comparisons are made across states or by new or changing versus older-traditional institutions.

Differences do emerge, however, when institutions are classified according to qualitative/quantitative, public/private, and functional type. For example, faculty participation is medium-heavy in those institutions characterized as having qualitative planning. A joint structure for planning is more often used by public institutions, and major universities are more likely to make special provisions for conducting research related to planning beyond the existing institutional research offices.

In general, the data show that administrative encouragement is most often cited as the reason for faculty involvement in planning. Other important reasons are the opening of a new campus or a major change in mission. It is important to note that these reasons derive from the organization or external system. Faculty are not generally motivated to participate out of a commitment to the importance of planning.

The reasons most often cited for reluctance to participate in planning include: planning is an administrative task; the traditional disciplinary orientation decreases commitment to the institution; faculty-administration and faculty conflicts divert available time and energy; and faculty are impractical, inexperienced, and incapable of taking an institutional perspective. These findings identify in part, a fundamental issue on institutional planning, i.e., planning is not thought of as a legitimate part of the faculty role.

Contrasts emerge when institutions are classified by the control variables. Cross-state comparisons show that administrative encouragement for planning is cited significantly more often in California and New York. That the external system encourages planning is mentioned significantly most often in New York. These findings can be accounted for, in part, by the legislative mandate for quadrennial planning in New York. Also, several of the institutions in the California sample are preparing 1968 plans. Our study coincided with the preparation of these plans, and thus we obtained higher response rates. A second factor accounting for this response pattern is the degree of decentralization in these states. In California and New York the responsibility for planning rests more with the segments, i.e., SUNY, CUNY, University of California, California State Colleges. In contrast, planning is controlled more centrally in Florida and Illinois through their respective statewide coordinating agencies.

In California, significantly more references are made to the fact that the external system hinders planning and that planning is seen as an ineffective means to ends. These two reasons are cited at almost every university, state college, and junior college in our sample of California institutions. This probably reflects, in part, the conflicts and tensions regarding the rather highly formalized and centralized systems for budgeting and program review. These often have the effect of stifling and undermining efforts toward creative and innovative planning. California also differes significantly from the other three states as regards the frequency with which internal faculty-administration and faculty conflicts is mentioned. Some of this conflict may be accounted for by the reasons cited in the second comparison. In addition, this high level of conflict, especially at the state colleges, reflects both efforts to increase substantially the voice of faculty in decision-making and the drive toward unionization.

No striking results occur when institutions are categorized by functional type. However, the view that the traditional disciplinary orientation hinders planning predominates in universities and is cited least often in junior colleges. Administrators tend to encourage faculty involvement in planning more often at state colleges and junior colleges than at universities.

A comparison of public and private institutions reveals some interesting differences. Faculty-administration and faculty conflicts are cited at 68 percent of the public institutions as the reason why faculty are reluctant to participate in planning. In contrast, this reason was cited at only 23 percent of the private institutions. Furthermore, faculty are less often viewed as impractical, inexperienced, and incapable of taking an institution-wide perspective in private institutions. The external system is considered a hindrance to planning at 50 percent of the public institutions but at only one private institution. Similarly, internal conflicts and the view that faculty are impractical, inexperienced, and incapable of taking an institution-wide perspective differentiate institutions doing quantitative planning from those doing qualitative planning. These findings suggest the types of institutional settings where planning has a more central role and where faculty are more actively involved. A more positive attitude toward faculty involvement appears to be associated with private institutions and those institutions where a more qualitative type of planning exists.

Again, contrary to expectations, no marked differences appear between new or changing versus older-traditional institutions as regards the reasons for faculty involvement. At a number of older-traditional private institutions, faculty are highly involved in planning. Thus, anticipated differences are canceled out by this intervening factor.

Summary and Conclusions

The most important findings are the following: (1) although the style and form of past planning differs in most respects from the general paradigm, a recent trend toward more comprehensive and sophisticated planning is developing; (2) faculty are more actively involved in planning when they receive administrative encouragement, when a new campus is being developed, or when the mission and role of an institution is undergoing a fundamental change. Reluctance to become involved in planning is associated with older-traditional campuses which have no special traditions or external pressures to promote and encourage planning, where internal conflicts are frequent, where faculty are perceived as not qualified to contribute to planning, and where a commitment by faculty and administrators to the traditional-discipline orientation predominates; (3) important differences exist in the type of planning, participation in planning, and reasons for faculty involvement when institutions are classified by state, by qualitative or quantitative planning, and by public and private; less dramatic contrasts occur when comparisons are based on functional type and new or changing versus older-traditional institutions.

The findings and conclusions suggest that faculty reluctance to participate in planning may continue until (1) the character of planning is changed toward a more qualitative, goal-oriented activity; (2) organizational and professional recognition and encouragement are given for participation in planning; (3) planning becomes a more central and effective instrument for change within higher education. The general paradigm presented earlier suggests the ways in which faculty can meaningfully contribute to a reformulation and a more sophisticated form of institutional planning.

Footnotes

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RESEARCH AND INFORMATION REPORTS ON THE TWO-YEAR COLLEGE: 1960-66

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The growth and development of an enterprise, whether it be in business, industry, or in the field of higher education, is largely related to the extent to which that enterprise is able realistically to appraise itself and its programs. In higher education the need for continuous self-appraisal is more crucial today than ever before. The extension of higher education both vertically and horizonally, along with an ever increasing public consumption and appreciation of its benefits, makes it mandatory that the higher education enterprise critically examine itself. Such self-examination, when done systematically and continuously, would enable institutions to apprise themselves of how well they are meeting their goals and to gain some insights in the changes needed for future growth and development.

The work of institutional researchers is one method by which colleges and universities appraise themselves and their programs. In recent years the support provided for research purposes has facilitated the growth of this activity and the reporting and publication of research results. Indeed, there has been a considerable increase in both the volume of articles published and in the number of new educational journals that have appeared on the educational scene. Also, the increase in the number of trained research workers has had a tremendous impact on research output. It has not only increased the volume of research but has improved the quality of published research as well.

The field of higher education which has shown a most dynamic growth in recent years has been the two-year college. Both from the standpoint of enrollments and from the standpoint of new colleges, the two-year college has increased at a much more rapid pace than other types of institutions. That the two-year college is interested in self-appraisal is evidenced by the numerous articles appearing in the literature. To obtain an overview of the research on the two-year college, an investigation was made of the literature on the two-year college that appeared in the professional journals from September 1960 to August 1966. An analysis was made of these articles and reports to provide an indication of the attention given to the various phases of the two-year college by researchers.

All articles on the two-year college listed in the Education Index between September 1960 and August 1966 are the subject of this investigation. Bibliographic information for each item of research was placed on a 3 x 5 card. Each item was classified by subject area, publication media, and position of author at the time the article was published. An examination of the journal articles provided the positions of the authors. It should be pointed out that (1) a number of items were excluded from the analysis because they were not germane to this effort; (2) we were not successful in obtaining the position occupied by each and every author; (3) this analysis includes 48 items which dealt with the two-year college but which did not carry authorship.

Essentially, the classifications of items on the two-year colleges by area of research and by position of author were identical with the classifications used in an earlier report on this subject.[1] However, the classification of publications' media used in the earlier article was changed to a two-way classification, *The Junior College Journal* and *Other Journals*, instead of the four-way classification used earlier. In addition, whereas in the previous article the authors excluded a number of items of research from the analysis, in this effort a more liberal approach was used in the acceptance of articles for inclusion in the analysis. Despite the fact that some 50 items were discarded, the total number of pieces included in the 1960-66 period surpassed the total number included in the 1950-60 decade. Although it can be assumed that research activity on the two-year college has increased at a rapid pace, because of the variation in the criteria used to include items in the pieces of research, it is not possible to pinpoint the changes in research productivity between these two periods.

We believe that the information provided by this analysis should prove valuable to those in the two-year college field. Such an analysis will enable two-year college workers to gain some insight into the area of research emphasized, as well as those not emphasized, by the various authors.

Analysis of Data

It may be seen from Table 1 that six of the twelve research areas--aims and objectives, curriculum, students, miscellaneous, external administration, and instructors--accounted for 75.5 percent of the articles on the two-year college that appeared between September 1960 and August 1966. The rank order for the first three subject areas--aims and objectives, curriculum, and students--are the same for both the 1950-60 and the present analysis. Overall, articles from 22.0 percent of the total for aims and objectives to 1.7 percent for rating and accreditation. The four subject areas that received less than 5 percent of the total included finance (4.9 percent), enrollment and statistics (4.0 percent), libraries (2.9 percent) and rating and accreditation (1.7 percent).

The *Junior College Journal* (JCJ) carried slightly over two-thirds (67.5 percent) of the articles on two-year colleges during the 1960-66 period. (In contrast, the JCJ carried slightly under two-thirds of the articles (65.6 percent) published during the 1950-60 decade.) Both the JCJ and other professional journals (OPJ) carried the heaviest representation of their respective totals on aims and objectives (18.8 vs. 28.5 percent). Interestingly, a comparison of the top six subject areas in the JCJ with the top six in the OPJ shows that the total for these areas comprised 74.0 percent of the JCJ articles and 77.6 percent of the OPJ articles. Articles on curriculum accounted for 16.7 percent of the total in the JCJ (an increase of 4.7 percentage points over the 1950-60 period). Articles on students showed a slight decrease (13.8 vs. 12.8 percent) when the respective totals for 1950-60 and the 1960-66 periods were compared.

The data in Table 2 differ from those in Table 1 in that they exclude 48 articles with no authors, and also exclude articles by senior authors whose positions were not determined. It should be noted that of the 595 senior authors, 46.6 percent held positions in junior colleges, 27.3 percent in senior colleges, and 26.2 percent held positions in state or federal agencies or nongovernmental agencies. Of the total number, slightly over one-third (35.0 percent) held positions in some phase of junior college administration. The group with the next highest record (20.7 percent) was the senior college faculty. The groups with the lowest and next lowest records were, respectively, senior college administra-

Table 1

ARTICLES PUBLISHED ON THE TWO-YEAR COLLEGE BY AREA OF RESEARCH AND JOURNAL CATEGORY: 1960-66

	Area of Research	Junior College Journal	Other Professional Journals	Total
1.	Instructors	36	15	51
2.	Libraries	15	5	20
3.	Students	68	22	90
4.	Enrollment and Statistics	14	14	28
5.	Internal Administration	34	8	42
6.	External Administration	32	19	51
7.	Aims and Objectives	89	65	154
8.	Curriculum	79	31	110
9.	Finance	27	7	34
10.	Rating and Accreditation	5	7	12
11.	Instruction	30	6	36
12.	Miscellaneous	44	29	73
	Total	473	228	701

tors and state and federal personnel. By contrast, the 1950-60 data showed the positions of senior authors to be as follows: 38.1 percent were employed by junior colleges; 29.3 percent by senior colleges; and 31.8 percent by the noncollege category. It is revealing to note that in both the 1950-60 and 1960-66 analyses, the heaviest concentration of articles written by four of six groups--junior college administrators, senior college administrators, and the noncollege groups--dealt with aims and objectives. Whereas the junior faculty group had the heaviest representation in articles on curriculum (40.6 percent of their total) in 1960-66, in 1950-60 the highest proportion of articles written by this group (33.3 percent) dealt with instruction. An apparent paradox is shown by the fact that in both the 1950-60 and 1960-66 analyses the highest proportions of articles (approximately 21.0 percent) by senior college faculty dealt with junior college students.

During 1960-66 the 701 articles on the junior colleges appeared in 79 different journals. There were 473 articles carried by the Junior College Journal, and 228 articles carried by 78 other professional journals during this period. OPJ's that carried six or more articles included: California Education (17), School and Society (15), Journal of Higher Education (10), Overview (9), Michigan Education Journal (9), School Management (9), and American School and University and Journal of Secondary Education (each with 6). Thus 7 OPJ's carried 72 articles--or stated another way, of the articles published on the two-year college which were not carried by the Junior College Journal, almost one-third (31.6 percent) were published by the 7 journals listed above. During 1950-60, articles on the junior college appeared in 67 different professional journals (including the JCJ).

Table 2

ARTICLES PUBLISHED ON THE TWO-YEAR COLLEGE BY AREA OF RESEARCH AND POSITION OF SENIOR AUTHOR: 1960-66

	College Positions				Noncollege		
Area of Research	Junior College: Faculty	Adm.	Senior College: Faculty	Adm.	Government Agencies	Other	Total
1. Instructors	12	10	15	0	3	6	46
2. Libraries	0	10	3	2	0	3	18
3. Students	7	29	26	8	4	10	84
4. Enrollment and Statistics	0	2	3	2	4	5	16
5. Internal Administration	0	22	11	1	3	0	37
6. External Administration	0	15	7	7	4	8	41
7. Aims and Objectives	11	47	16	9	15	28	126
8. Curriculum	28	29	20	5	6	8	96
9. Finance	2	9	3	3	8	5	30
10. Rating and Accreditation	0	2	3	1	3	1	10
11. Instruction	6	17	4	0	5	3	35
12. Miscellaneous	3	16	12	1	10	14	56
Total	69	208	123	39	65	91	595

Between 1960 and 1966 there were 732 authorships of articles by 534 different individuals. The tabulation on frequency of authorship includes articles which have one, as well as more than one, author. Not included in this tabulation are 48 items which carried no author's name. Of the total number of different authors, 433 had their names on single junior college articles. However, as was found for the 1950-60 analysis, a small number of individuals was responsible for a heavy representation of research activity in this field. This is shown by the fact that 41 individuals (less than 8 percent of the total) authored or coauthored three or more articles and accounted for almost 25.0 percent of the total number of articles.

As was indicated above, junior college administrators were responsible for 35 percent of the publications on two-year colleges during 1960-66. To obtain an indication of the extent to which junior college presidents, vice-presidents, and deans published during this period, an analysis was made of the data pertaining to two categories of administrators--(1) presidents and vice-presidents and (2) deans (including deans of instruction, admissions, students, or administration). Omitted from this subanalysis were the publications of assistant deans and of administrative personnel who did not carry one of the titles indicated above. In articles with more than one author, only if the senior author held the title of president, vice-president, or dean was the article included in the analysis.

The most striking revelation is that of the 144 publications of top junior college administrators, 87.5 percent appeared in the Junior College Journal. Almost as striking is the fact that of the 208 articles published by junior college administrators, the president, vice-president, and dean group authored 69.2 percent. Four areas, aims and objectives, curriculum, students, and internal administration, accounted for almost two-thirds (65.3 percent) of the total output of this group. More than one-fifth (22.2 percent) of the articles published by this group were aims and objectives type articles. Areas which received little or no treatment by this group included rating and accreditation, enrollment and statistics, libraries, and finance. Although presidents and vice-presidents account for a much smaller proportion of top administration than do the various deans, the frequency of publication of the former group surpassed that of the latter group by a considerable margin--accounting for 59.7 percent of the 144 articles published by administrators.

Discussion and Implications

This analysis of publications on the two-year college was made for the purpose of providing those interested in the junior college field in particular, and those interested in higher education in general, with information on the volume and areas of publications on two-year colleges during the 1960-66 period. Further, the results of this analysis have been compared with those of a previous analysis covering the 1950-60 period Although a publication could be classified equally well in two or three subject areas, the margin of classification error was greatly reduced in that the same procedure used in the classification of the 1950-60 publications was used in 1960-66 publications. In addition, the classification of publications of both analyses was done by the same person.

In this report, as well as in the previous one, the position of the author at the time his publication appeared in print was used to provide an indication of what group of people write on what subject. It was not possible to obtain the position of approximately 10 percent of the authors.

One of the salient findings of this study is the acceleration in the number of articles on the two-year college that appeared during the six year period of the sixties. Whereas during the 1950-60 decade the yearly average was just under 61, during the 1960's the yearly average was well over 100. Whether this significant increase in yearly averages is due to better research preparation of people interested in the development and growth of the two-year college or whether it is because there are more people in the junior college field is difficult to ascertain. It can be assumed, however, that the availability of training programs, the expansion of opportunity for two-year college workers, and the influx of federal money in the junior college field accounts for more and better publications.

Notwithstanding the increased tempo of junior college publication during the sixties and the reputation of junior colleges as teaching institutions, the relatively low participation of junior college faculty in research and publication on the two-year college is a question that bears consideration. On this point, it is encouraging to note a slight increase in the proportion of total articles published by junior college faculty. They accounted for 11.6 percent of the total articles published in 1960-66, an increase of 2.3 percentage points over 1950-60. Also, whereas in 1950-60 the junior college faculty ranked fifth in the number of articles published by the six groups, in 1960-66 they ranked fourth. Certainly the availability of better qualified personnel as teachers in junior colleges would augur a keener sense of curiosity and resultant research on the part of junior college faculty. In any event, it would be expected that the faculty component of the junior colleges would lead the way in research pertaining to curriculum, instruction, and students. In each of these areas the record of junior college administrators was better than that of faculty. When one considers the faculty-administrator ratio, this finding becomes even more appalling.

As to the professional position category that was most productive in junior college publication, junior college administrators wrote almost 70 percent more articles than did the next highest group of writers--four-year college faculty members. Junior college administrators produced the most research publications of any group in both 1950-60 and 1960-66, accounting for approximately 30 percent of the publications in the former period and 35 percent in the more recent period. The reasons for the prolific productivity of junior college administrators are not easily discerned--however, the areas in which they published most frequently were not internal or external administration, their immediate areas of responsibility, but in aims and objectives, curriculum, and students (perhaps, because the administration category included dean of students, the last area mentioned should not be unexpected). Interestingly, when the administrator category is broken down, showing the research activities of presidents, vice-presidents, and deans (excluding assistant deans and other administrative positions), the results are remarkedly similar. The three subject areas which received the heaviest concentration of research effort of two-year college administrators in 1950-60 were--aims and objectives, students, and curriculum. Of course it may be rationalized that the experiential and training levels of the two-year college administrator are broad in scope and that these qualities enable them to address themselves to investigations on many two-year college subject areas. On the other hand, it may be posited that administrators are too busy to heed the requirements entailed in research and design and data organization, treatment, and analyses.

An encouraging aspect of the findings of this analysis is the increase in the number of different journals which carried articles on the two-year college. The dissemination of information to the readers of the various journals renders a service which can contribute to a better understanding of the two-year institution. Although there were more articles carried by other professional journals in 1960-66, the proportion of the total published by these journals as contrasted to the number published by the Junior College Journal was less in 1960-66 than in 1950-60.

In conclusion, the findings of the 1960-66 analysis appear to resemble the findings of the 1950-60 analysis. Research and reporting activity on the two-year college has accelerated during the 1960's. However, classroom instructors and special service personnel (i.e., counseling and guidance personnel) have not made much headway as authors of junior college reports. This finding would suggest the need for the creation of more favorable conditions for research and reporting activites for instructors, counselors, and other special service personnel at individual two-year institutions. The creation of more favorable conditions may necessitate lower teaching loads for instructors and released time for special service personnel. Concomittant with such a procedure, of course, individual institutions should sponsor research institutes or workshops for personnel interested in acquiring research skills and also have some funds available which are earmarked for the promotion of research activities for this group. It can be assumed that the experiences of this large group--especially in the areas of curriculum, instruction, and students--can provide the junior college field with insights which will help institutions to appraise their progress and development more fully.

METHODOLOGY IN STUDIES OF INSTITUTIONAL CHARACTERISTICS: A CRITIQUE OF EXPERIMENTAL DESIGN

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Anyone close to educational research in higher education is certainly aware of the "explosion" in studies on institution/student characteristics. These studies have come on the wave of a massive movement in higher education that prefers to identify institutional posture and quality in terms of student behavior. It is probably a truism to assert that studies of institutional characteristics are really studies of student characteristics. If one overlooks the administrative research studies of space utilization, budgeting practices, and the like in higher education, one sees a few thousand professionals with their ear to the chest of the student "body." They hear such strange things that they discover their theory repertoire and their instrument arsenal are no more contemporary than a suit of armor. When the researcher occasionally does tear himself away from his charismatic clientele he stares in wide-eyed amazement, shaking his head, and mumbles something that sounds like, "Ids, archetypes, functional autonomy, and S-R's sure don't work on this one!" He intermittently harangues the sociological and psychological theorists for being so inane and the psychological instrument makers for being so provincial.

Lo the pendulum swingeth! Everyone is getting into the act. The sociologist and psychologist see the college and university as a veritable heaven for theorizing, "instrumenting," and researching. A new breed of bureaucratic beast has emerged called the director of institutional research and every self-respecting campus has one of its own. Instrument files are filled with new and exciting barometric devices. Corporations are appearing for the purpose of assisting in institutional studies and existing ones are quickly mobilizing themselves for the market boom in instrument development and distribution, computer services, and consultant assistance. Our vocabulary is being expanded to include such terms as campus climate, student press, student succorance, institutional profile, expectation lag, dropout syndrome, affective domain, student subcultures, and student-college fit. And, the humanities departments have resigned en masse upon hearing the word that the bureau of educational research has just successfully normed creativity and will be using same in the admissions grid for next fall.

Accepting your criticism for being ludicrous, I wish to focus our attention more closely on the task at hand. I am taking the position that but for slight exceptions, studies of institutional characteristics are necessarily studies of student characteristics. Either a student is asked straight out about his perceptions or opinions regarding an institutional characteristic (as in the College Characteristics Index), or he provides a response to a personality type device and the collective responses of the students become an institutional characteristic (as in the College Student Questionnaires). In both cases the institutional characteristic is essentially a student characteristic.

These characteristics studies are used in such concerned areas as admissions, student development, attrition, institutional description, accreditation defense, and the like. Until recent years our concept of individual differences pertained to particular persons, but now we meaningfully use the term to refer to whole student bodies and student subcultures. Admissions persons realize that three or

134/135

four generalized academic student characteristics are not very successful in predicting the fit of a given student to a given college. College student personnel officers are disturbed when high school valedictorians drop out, and when apparently tame freshmen become sophomore "pistols." They realize that if high school was heredity then campus climate is environment and both must be recognized. College faculties are not content to merely describe educational outcome in terms of grade point or Graduate Record scores, since they contend for a plus outcome even in the affective domain. As more and more emphasis is being placed on institutional distinctives, colleges and universities are thrashing about for unique indices on their students. An occasionally outraged and more often shocked public asks for explanations for the social and personal decorum of college and university students. All these and still other reasons call forth the magnitude of student characteristic studies so much in vogue today.

Although problems in research design and methodology would pertain to such educational research areas as faculty load studies, enrollment projections, campus planning, curriculum research, and faculty evaluation, I wish to speak more particularly to studies in student development, or if you please, student characteristics.

Educational research in colleges and universities may be considered as predictive, directive, or illuminative. Predictive studies aim to tell us what will result from some specific educational practice or pattern. The studies for admissions success is an example. Directive research which intervenes directly into educational practice with statements of what ought to be done on the basis of findings, is rather less common than the other two varieties. Illuminative studies, unlike predictive studies, are not concerned primarily with establishing a close statistical connection between one or more characteristics of students and predicted educational outcome. Unlike directive studies, illuminative studies do not assimilate policy-making to research. It aims to explore, describe, and illuminate the nature of educational institutions and processes--to show what connections, if any, exist among student characteristics, organizational patterns and policies, and educational consequences. It is concerned especially with the ways in which these and other components of educational systems interact with one another.

Still other ways of classifying educational research on student characteristics include cross sectional vs. longitudinal, as well as distinguishing among inter, extra, and intra-institutional research studies. A personal observation on student characteristics studies suggests that they have been most descriptive, cross sectional, and intra-institutional. Without pursuing the concern of this paper any further, some methodological shortcomings and design weaknesses are more than obvious. But in the remaining paragraphs I wish to point out a few selected concerns which I feel are plaguing existing student characteristic studies.

Some Problems Regarding Basic Assumptions in Student Characteristic Studies

Although seldom stated explicitly in such studies, there are some implicitly assumed ideas that provide some basic and contextual frameworks. One of these is the idea that college is probably a good place to be. The point of reference for studies in student development is the student rather than the nonstudent. Yet, would it not appear sensible to use age groups at large for our point of reference rather than excluding a large part of the youth population and beginning with a rather unusual group of youth called college students. To use only students in studies of student characteristics provides a most devastating incest to data as well as to norms. By implication, most studies on student characteristics perceive the nonstudent as someone less desirable, and the only one truly worth studying is the one who chose us as an institution. Studies in admissions are probably most at fault in making the assumptions regarding the goodness of college. Most studies have the college's interests more at heart than the student's interests. Such studies assume that the college should be comfortably filled with happy students and the resulting data is used to handle dissidents and unlikelies. Whenever student data uncovers a dissonant or unlikely individual, measures are taken to see if the student can stand up under the *sine qua non* success criterion: our college's survival norms.

Another idea that erodes studies of student development is that college stay-ins are a "good" point of reference for looking at students in general. Pupil personnel officers as well as research people make the concerted value judgment that students who do not leave our comfortable college clime are the "good guys" and all others are the "bad guys." Even though the educational researcher has typically taken pride in his objectivity, he still cannot escape the design bias in the very way he writes his hypotheses and his conclusions. But what are we going to do with pervasive data which suggests that the dropout is more intellectually disposed than his stay-in counterpart; that he is more expressionistic, independent, and creative.

I see another problem in assuming the adequacy of the term dropout. It seems that education is overburdened with ill-defined or undefined constructs. The difficulty in researching characteristics supposedly related to these constructs becomes formidable. I simply suggest that some new terms could provide some conceptual utility over such an awesomely ambiguous term as dropout. A recently reported study among universities in the University of Wisconsin system indicated that so-called dropouts have better than sixty percent of their ranks re-enroll in some recognized institution of higher learning within two-and-one-half calendar years of the identified time of dropping out of institution A. The term dropout also bears with it the assumed stigma that all students must inexorably accept if they leave our particular institution. I certainly think the term "leaver" has more desirable qualities, but even it must be used in the light of longitudinal pursuit to see if the leaver is a permanent absentee from future college experiences or not. The Wisconsin studies also indicated that future records of the registrar's office indicating a request for transcript are not valid indicators of a leaver's intention to enroll in another institution. The perceptible and insightful leaver sometimes decides his past transcript from institution A was a liability and re-enrolls without it ever being known to institution B.

And then, what about the student who leaves at the request of the institution? Should he be indiscriminately classified with the voluntary leaver? Will not his characteristics differ from the volunteer? Maybe the term dropout would be more acceptable if we could add the classification of "shutout." And again, can we assume that all students who stay in, should stay in, or want to stay in? Would not intuition tell us that differences in student characteristics occur among the mere stay-in and the "shut-in," the shut-in due to Viet Nam, mother-daddy pressure, etc.? I think that many designs in student characteristic studies are suffering from a devastating disease best diagnosed as "hardening of the categories," hangovers of preresearch eras!

Closely aligned to the ideas just presented, is the idea that a college is to meet all the educational needs of those who enroll. This seems to be an assumption that cuts across many studies in student characteristics, particularly those dealing with attrition. Once again the hypotheses are stated against the student who may choose to do otherwise than remain as a full-time student in college A. This point has been made in earlier discussions and will not be pressed again here.

Studies in student characteristics would do well to study the student while in the ongoing process of dropping out rather than after he has dropped out. Many studies appear to want to lock the barn door after the horse is stolen. In this sense, such studies are terminal! They provide little or no integrative information, but merely tell us how we failed but in splendid terms. After a student leaves we then go back and parcel out his scores and make comparisons with those who did not leave. I am suggesting that studies in student attrition would do well to identify a dropout syndrome and suggest preventive means as part of the diagnostic process. But alas! An all too common procedure is to feed the dropout characteristics back to a multiple regression admissions formula and cure by eradication! This has a morality akin to abortion, when a priori data are used to eliminate the unborn fetus' (high school senior) chance at living (college).

I think one of the most cogent criticisms regarding design in student characteristics studies is the lack of noncollege controls. We college people think that college history is the only one that can teach us anything. We attempt somewhat to deal with this problem when occasional interinstitutional comparisons are made and when nationally or regionally normed instruments are employed. With all the regimen of a salmon counter on the Columbia River fish ladders, we have relentlessly accumulated student data--everyone that crossed our research thresholds now has a set of punch cards. But it seems sound to reason that if we could know more about all the fish we could make some more intelligent conclusions about ours. I do not mean mere comparative data with other fish like ours in other colleges and universities, as important as that information can be. The implications of noncollege information would be most profound on admissions, attrition, and change studies. A noncollege control should not be a conglomerate control group but a paired control group, with matched characteristics with in-college groups. For example, a study of my own attempts to match a group of telephone operators with a group of college girls on the basis of high school IQ, GPA, SAT, and some personality indices. An attempt in observing change as a result of college experience is being counterbalanced and covaried with noncollege controls. I am inclined to believe that youth with certain characteristics are inclined to change in certain directions regardless of college or not. I am also inclined to believe that student characteristics during four years of college will change more than not in keeping with youth of the same age at large. The permeability of the college climate more than offsets any insular treatment. If such conditions do exist, then I know of two or three prominent studies which will have the rug pulled out from under them. I am also inclined to believe that students in various kinds of institutions (as defined in terms of institutional control) will not differ significantly when covaried and counterbalanced with the characteristics of youth at large. Without noncollege controls, most of our conclusions derived so far from student characteristics studies are mere artifacts of data incest. Until such noncollege controls are built into some of our studies, my expressed inclinations cannot be disproven.

Another flaw I have observed is so basic that I hesitate to even mention it. It has to do with the simple Pearson product moment correlation coefficient and its employment in student characteristics studies. I have observed two colleges in the past few weeks who were making a cause-effect assumption regarding two or more factors in a correlation derivative. Because a high school student characteristic (usually referred to as a predictor) occurred temporally prior to a college student characteristic (usually referred to as a criterion), one can easily overlook some of the theory underlying the simple r, and proceed to assume a causal rather than concurrent relationship to exist between (or among) the factors. The r is insensitive to temporal lag in data and merely assumes that concurrent conditions exist. The expanded multiple regression or discriminant function is designed to be used for making predictor indices to infer criterion indices. But even this is abused by many admissions grids and cutting points, since such data is often exercised from freshmen-to-be and thereby lacks a desperately essential ingredient: verification. In spite of regression weights, such data are still on students "as is," and are merely a "splendid r." As I understand both regression and discriminant analyses, they do not indicate a cause-effect relationship, but merely a predictable relationship. And then, to confound the issue even more, we proceed to administer the derived data on individual cases of admission or some other individualized decision, when in fact, the data being used (abused) were derived from distributions of individual cases. The only reference to individual cases in either the Pearson r, the multiple regression, or the discriminant function is in terms of relative rank positioning--never in discreteness.

I am fully aware of the ACT and SAT data and research services and celebrate the fact that such services are available to single purpose institutions as well as to the multiversities. I offer no indictment to either agency, but suggest that more assistance be given colleges in use of the data in appropriate decision-making. To show a college clerk how to merely plug a regression formula or plot a predicted GPA is not what I have in mind. In fact, such information could become more a part of the problem than the answer.

And finally, another profound problem facing studies of student characteristics is the need of relevant theory, and conversely, the translating of institutional problems to theory constructs and back again. This comes not so much as an indictment of any one but more as an expression of the futility of everyone. An instrument or a datum is only as useful as theory permits it to be. We find it hazardous to borrow promiscuously from psychological theory or sociological theory, yet we find so few persons theorizing heuristically regarding the college student scene. We will all confess that Pace, Stern, Clark, Trow, Peterson, and Heist are beautiful breaths of fresh air, but current educational research in student characteristics desperately needs better ideas. I celebrate any attempts to fill this extensive vacuum.

FD'S AND SD'S--NEGLECTED DATA IN INSTITUTIONAL RESEARCH

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Institutional impact is usually assessed by testing the same individual at two or more points in time and looking for change in mean scores. When mean scores at the later testing are significantly different it is assumed that change has occurred and the notion that the intervening experience had some influence is entertained. When no significant differences in mean scores are observed it is usually assumed that change has not occurred and that the intervening experiences have had little impact, at least in the areas under assessment. In more comprehensive studies with numerous variables multivariate analyses are employed to discover the major directions of change and the major constellations of experience, background, or prior predispositions relevant to the change. But both these levels of examination--discrete analyses of separate variables and multivariate analyses--as they are usually implemented share a fundamental weakness. They reflect change only when everyone moves in the same direction or when those moving in one direction substantially outweigh, either in numbers or in amount of change, those moving in another. They do not reflect the nature of the change nor do they suggest areas of institutional impact when individuals move in contrary directions.

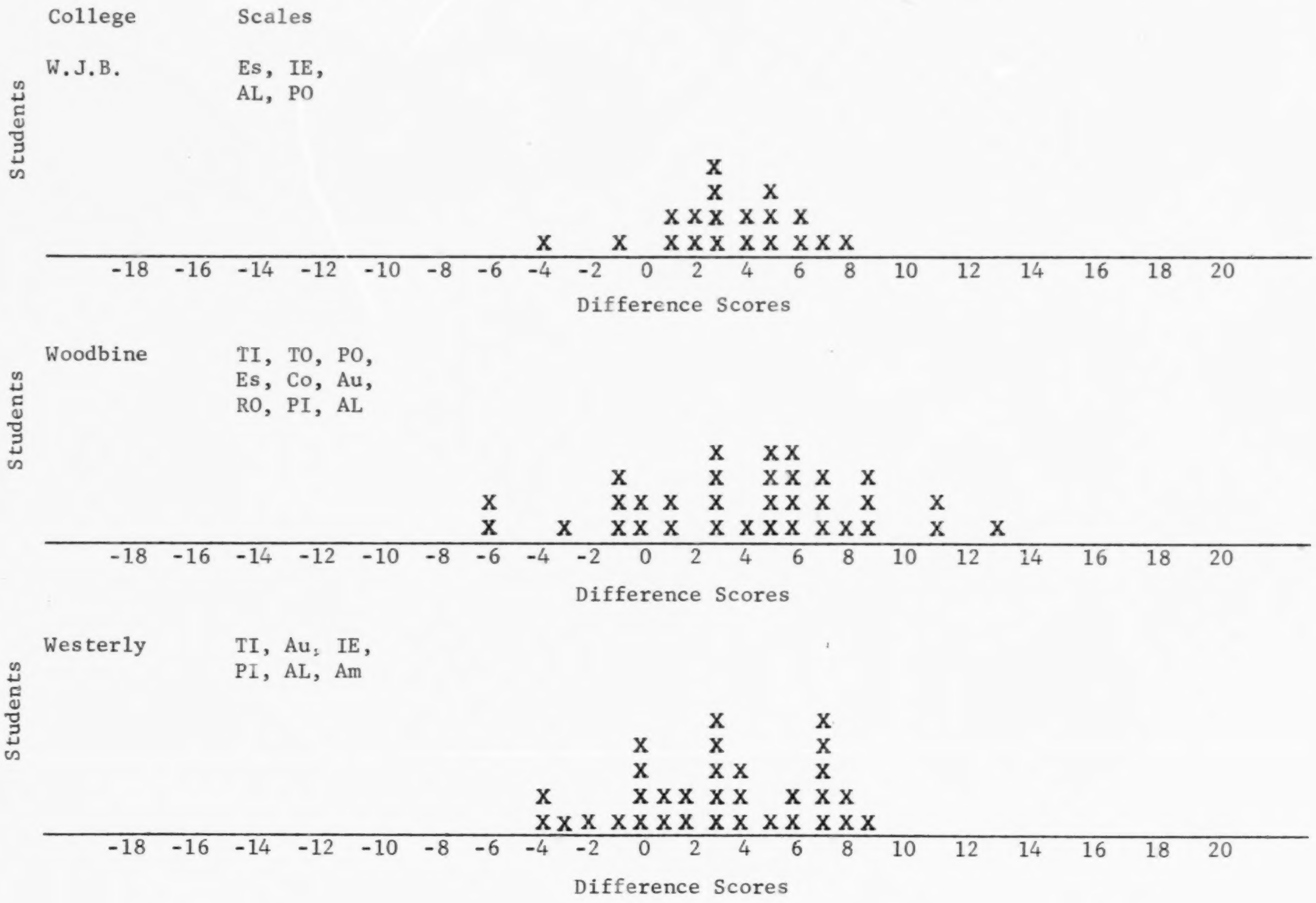
Some frequency distributions for change data from the Omnibus Personality Inventory (OPI) are illustrative. These figures were generated simply by subtracting individual standard scores at first testing (entrance, 1965) from their scores at second testing (end of sophomore year). Thus they are frequency distributions of difference scores for change during the first two years. Standard deviations for OPI scales are usually about 10 so a difference score of ten represents an individual change roughly equal to one standard deviation.

The three distributions in Figure 1 result from pooling difference scores for all scales which reflected significant change for that institution. They represent therefore, the general thrust of change at that college. Pooling was achieved simply by summing the difference scores for all scales for each individual and then dividing by the total number of scales. The distributions differ somewhat. At W. J. B. only ten percent change against the tide and they don't move very far; the small changes in the opposite direction by the other ninety percent are sufficient to generate statistical significance. At Woodbine about twenty percent move in contrary direction but they are counterbalanced by a few whose scores reflect substantial change and by the more moderate change reflected by the others. At Westerly, although about twenty-five percent shift against the general thrust, they do not go so far and the moderate change by the other seventy-five percent carry the central tendency to significance. The peaks in the Westerly distribution suggest clusters of students worth further study. Perhaps differential predispositions or differential experiences are associated with these different degrees of change.

It is possible of course, that such results are a function of measurement error. Its effect is always difficult to ascertain and the difficulties are compounded when dealing with difference scores. The reliabilities for the OPI scales are quite high; two test-retest studies over three- and four-week time intervals generated coefficients ranging from .79 to .95. But even those reliabilities leave room for uncertainty when the measures are used to assess change.

Figure 1

Individual Difference Scores for Scales Reflecting Significant Mean Change



However, study of individual patterns across scales which reflect mean change suggest that something other than measurement error is operative. Students swimming against the institutional current--changing counter to the mean change--tend to do so rather consistently across several scales, and those swimming vigorously with the current do so consistently also. Thus these different distributions do seem to reflect differential individual-institution interactions, and not simply random errors of measurement.

These patterns are about what one might expect to underlie significant mean change. But we should not forget that the different patterns may be of major importance to the institutions under study. When most students move in the valued direction and when negative change is limited in degree and in frequency, as at W. J. B., there is ground for satisfaction. But if twenty or twenty-five percent are changing negatively to a substantial degree, such a shift may far outweigh the gains made by others. Some elementary schools, for example, teach a majority of children to read and to learn but also teach a minority to reject reading and learning. Substantial money and energy is currently being applied to that problem. Similarly, a college that would develop autonomy and integrity may not be satisfied with such development for eighty percent, when the other twenty percent become more dependent and hypocritical. Thus, examination of the frequency distributions underlying significant change may often be of great practical importance.

Figure 2 presents two frequency distributions underlying scales reflecting no significant change. In both these distributions difference scores cluster around the zero point and few persons shifted far in either direction. An assumption of minimal change or impact is probably sound here.

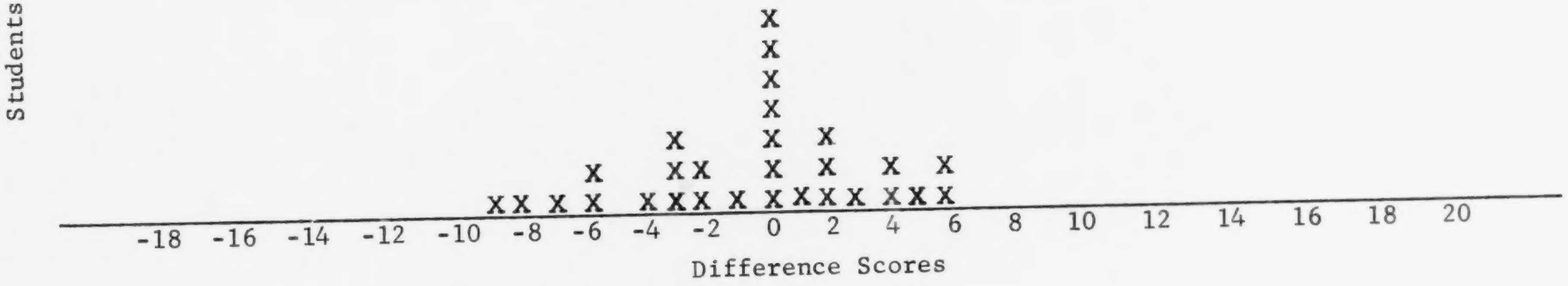
Figure 3 presents two other distributions for scales reflecting no significant differences, but these patterns differ markedly from those in Figure 2 and also differ from each other. Stonewall reflects a wide range, but a relatively large minority are close to the zero point. The Woodbine distribution is much more flat however, with the preponderance of students reflecting change in one direction or another. Both these distributions suggest that something is going on, that something is operative within individuals or within the environment to foster change. There are different individual reactions but most are affected one way or the other, especially at Woodbine.

Such a finding should not be surprising. A little reflection will recall that many powerful singular experiences and many conditions less powerful but encountered over time, produce quite different reactions. Indeed polarization of attitude and behavior is a typical result as issues become more salient, as the forces at work become more powerful, as personal experiences become more direct and intense. The extremist responses to the intensification of the Vietnam conflict are a pervasive example. The similar polarization of attitudes and behavior exhibited by northern communities in response to housing integration and more currently in response to black power is another example. And we have seen similar reactions on our own campuses. The general education program opens doors for some students and leads to diversification and intensification of intellectual interests. Others define college purposes more narrowly in terms of vocational preparation. A charismatic leader converts large numbers to the fold--be it free speech or fundamentalism--and at the same time turns others in the opposite direction. Some students respond to freedom and the opportunity for self-government by developing autonomous control and personal integration; others disintegrate and become governed by impulse and hedonism.

Figure 2

Individual Difference Scores for Scales Reflecting No Significant Mean Change
Minimal Individual Change

College	Scales
Kildew	TI, AL, IE



Friendly	RO

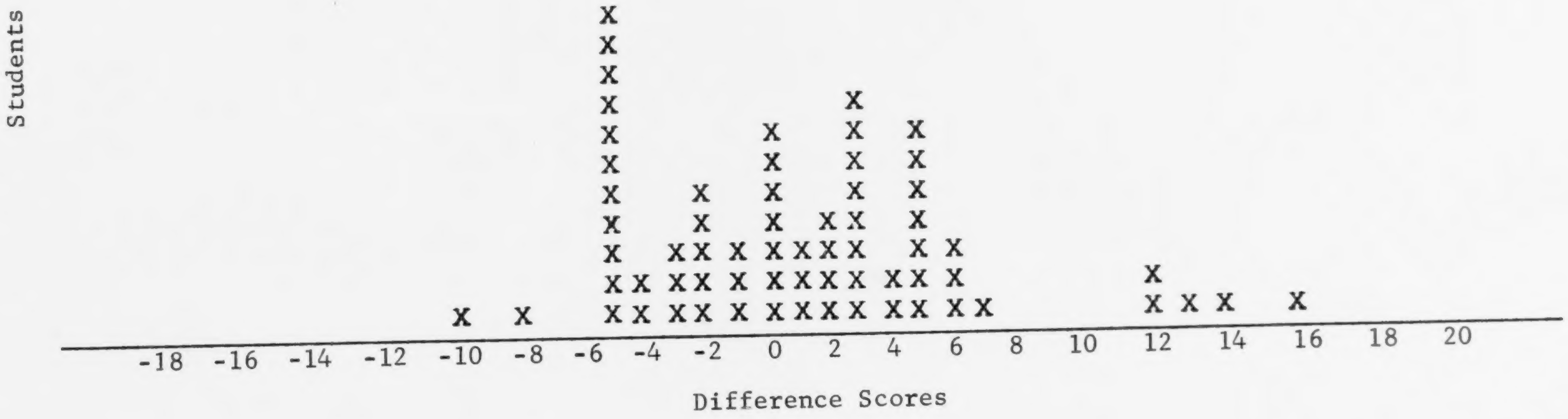
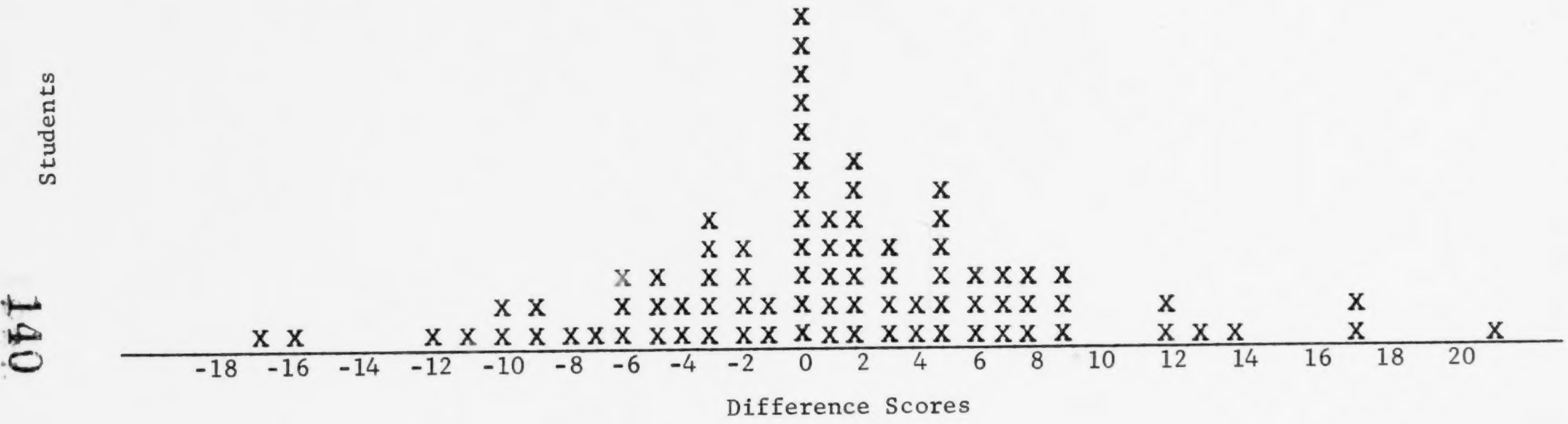


Figure 3

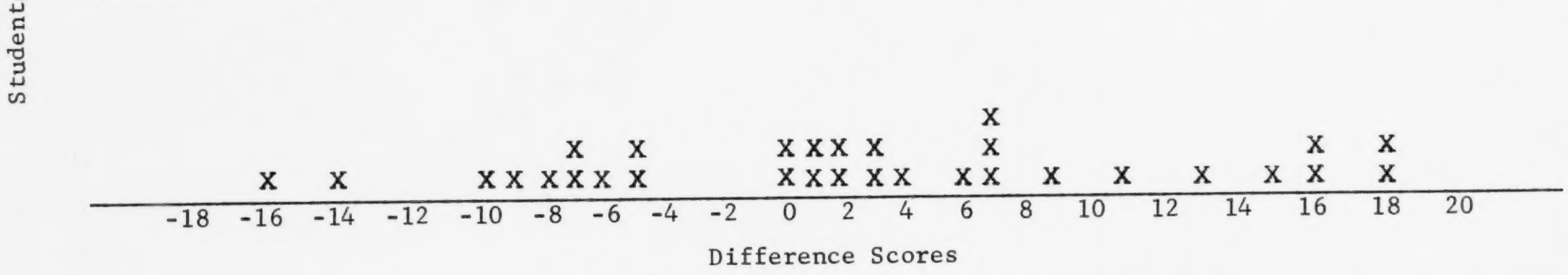
Difference Scores for Scales Reflecting No Significant Mean Change
Substantial Individual Change

College Scale

Stonewall TI



Woodbine Co



Basically, the point is that when a strong force is at work, a group may respond either in rather homogeneous fashion, with all members shifting similarly, or it may respond in quite heterogeneous fashion with substantial proportions shifting in quite different and often opposing directions. Assessment of institutional impact requires attention to both patterns of response. Do the frequency distributions in Figure 1 reflect greater change than those in Figure 3? Which sets suggest greater institutional impact? Probably the distribution for Woodbine on Figure 3 signifies more institutional impact than any other. Furthermore, distributions like these are not rare. For seven of our project colleges two or three scales were selected which did not reflect significant change, and of the fifteen possible cases, eleven distributions were like those in Figure 3.

Of course there is one practical clue to the underlying distribution--the standard deviation. The neglect of standard deviations in interinstitutional studies and in longitudinal studies of change is both striking and surprising. Analyses of differences in standard deviation can suggest whether polarization and diversification has occurred or whether the trend is toward increasing homogeneity. Where standard deviations increase, study of underlying distributions may be profitable. Tables 1 and 2 show changes in standard deviations from test-retest studies of the same persons at entrance and the end of the first year. In Table 1 there are interesting interinstitutional differences. At most colleges standard deviations for the fourteen OPI scales more frequently increase than decrease. But for men at Woodbine, Stonewall, and Classic the reverse is true. For women standard deviations also generally increase, but with less frequency, and for Friendly, Maestro, and Bootstrap standard deviations more often decrease. Kildew and Simon are the two institutions where increasing standard deviations occur most frequently for both sexes and Classic is the only college where standard deviations decrease in a majority of cases when both sexes are combined. Thus the trend at Kildew and Simon is toward increasing diversity and individuality from entrance through the second year while at Classic the trend is toward increasing similarity. Table 2 shows changes in standard deviations by scale for eleven of the thirteen project colleges. For men Practical Outlook, Thinking Introversion, and Estheticism most frequently reflect increasing diversity, while Theoretical Orientation, Religious Orientation, Impulse Expression, and Response Bias less frequently increase. For women standard deviations most frequently increase across the scales but the differences are again less pronounced than for men.

Detailed substantive interpretation of the implications of these changes in standard deviation is not appropriate to our present purposes. There is obviously more to be said, and examination of relationships between institutional characteristics and differing patterns of increase and decrease across scales would yield productive insights. But our principal concern here is methodological, and these data are sufficient to suggest the value of giving attention to standard deviations, both for the clues they give concerning whether study of underlying distributions is necessary, and for the insights they yield in their own right.

On the basis of these explorations it seems clear that judgements concerning institutional impact and student development must take frequency distributions and standard deviations into account. Averages obliterate individuals and therefore fail to reveal the complex interactions which determine each event and its developmental consequences. Simple reliance on measures of central tendency, therefore, is not enough, because important areas of institutional impact may be missed. Equally important, knowledge of the underlying distribution is often necessary for sound interpretation of significant mean change.

Table 1

CHANGE IN STANDARD DEVIATIONS FOR FOURTEEN OPI SCALES

	Colleges											
	W.J.B.	Elder	Simon	Friendly	Maestro	Bootstrap	Midwest	Westerly	Kildew	Woodbine	Stonewall	Classic
Men												
Scales Showing Decreased S.D.'s	3	4	3	3	1	1	no men	6	3	7	9	9
Scales Showing Increased S.D.'s	11	10	11	11	13	13		8	10	7	5	5
Women												
Scales Showing Decreased S.D.'s	6	6	5	8	8	9	5	5	3	2	6	7
Scales Showing Increased S.D.'s	8	8	9	6	6	5	9	9	11	12	8	7

Table 2

CHANGE IN STANDARD DEVIATION AMONG PROJECT COLLEGES

	OPI Scales													
Men	TI	TO	ES	CO	AU	RO	IE	SE	PI	AL	AM	MF	RB	PO
Colleges Showing Decreased S.D.'s	1	5	2	5	3	5	6	3	4	4	4	2	5	0
Colleges Showing Increased S.D.'s	10	6	9	6	8	6	5	8	6 (1 tie)	7	7	9	6	11
Women														
Colleges Showing Decreased S.D.'s	5	6	4	4	4	7	6	7	5	2	3	6	6	5
Colleges Showing Increased S.D.'s	7	6	8	8	8	5	6	5	7	10	9	6	6	7

Indeed, if a proper objective of general education and liberal arts colleges is personal expansion, autonomy, and full realization of individual potentials, then it could be argued that increasing standard deviations are good evidence of institutional success. For the outcome of effective liberal education should be increased differences among individuals and increased diversification of talent, attitude, and value. Such an outcome is an essential contribution for undergraduate education to a pluralistic and democratic society and measures of central tendency are not sufficient for its appraisal. If institutional effectiveness is to be soundly appraised and if the dynamic relationships among institutional characteristics, personality predispositions, and student development are to be understood, institutional research must venture beyond the mean to underlying frequency distributions, to standard deviations, and to other measures descriptive of those distributions and their shifting patterns.

STUDIES OF INSTITUTIONAL ENVIRONMENTS: CATEGORIES OF INSTRUMENTATION AND SOME ISSUES

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Within the past ten years there has been increasing interest in studying student development during college. Paralleling this interest have been attempts to measure college environments; researchers have not only tried to assess what happens to college students but where it happens as well. Spurred perhaps by Jacob (1957) and Eddy (1959) who said that some institutions seemed to have a climate or level of expectation that facilitated changes in students, the environmental studies have used several approaches. Best known, possibly, is the student-perception-of-environment approach. Pioneered by Pace and Stern (1958), the student perception method relies on students' reporting general characteristics of their institution and their peers. Thus students respond to such statements as, "There are frequent informal social gatherings here." At this time, probably a third of the four-year institutions in the United States have used either Pace's (1963) College and University Environment Scales (CUES) or Stern's (1958) College Characteristic Index (CCI).

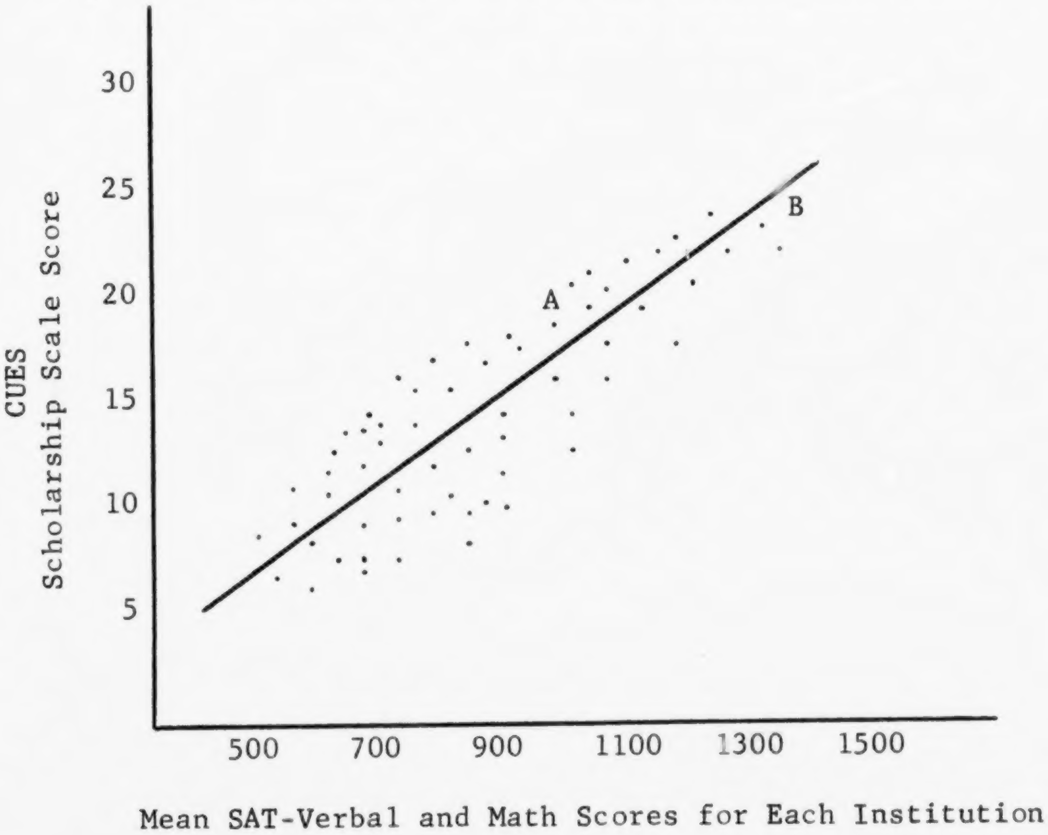
Another well-known environmental assessment technique is that used by Astin (1965a, 1967) and, to a more modest extent, by Warren (1966). Unlike the perceptual approach, this latter technique asks a student respondent how many hours he has spent in various activities, how many times he has cut classes, and the like. Individual student behavior is the focus, and the college environment includes any characteristic of the college that might be a potential stimulus for the student (Astin, 1965a, 1967). Because students are reporting their own behavior rather than their perceptions of how students behave generally, there may well be differences in the way each technique describes the same environment. For example, students may on the one hand report that intellectual discussions are infrequent on their campus, but at the same time they may say that they themselves frequently engage in such discussions. In short, self-aggrandizement, not a new phenomenon in social science research, may affect responses. Furthermore, there are some methodological differences to keep in mind. The student-self-reports-of-behavior technique relies heavily on obtaining a sample of students that is truly representative of an institution, since student responses are to be averaged as an institutional score. It is often difficult to obtain the cooperation of an appropriate sample, particularly at complex institutions where there are many types of students. Although sampling is less crucial with the perceptual approach because students are already reporting generalized behavior, additional questions may be raised. For example, to what extent do students report an image that is outdated and no longer true of their institution (an "image lag")? Furthermore, how valuable is the current perceptual approach in studying differences within the environment of a large institution? The diversity within a large institution, such as that found at the department level, may well be its most significant feature (Centra, 1965).

The Effect of Student Input on College Environments

Still another question might be raised regarding both environmental assessment techniques discussed thus far. To what extent is the environment of a college or university related to the students who attend? That is, to what extent is environment related to attributes students bring with them? An earlier approach by Astin and Holland (1961), called the Environmental Assessment Technique, relied heavily on academic and personal characteristics of students who attend an institution as an assessment of its environment. Further evidence of the relationship between input and environment has been provided by Pace (1967), who reported correlations of .60 between the CUES Scholarship score of 49 institutions and their Scholastic Aptitude Test Verbal means for entering freshmen. With this in mind, I have recently begun investigating characteristics of college environments with student academic input at least partially controlled. Using a multiple regression model, the intellectual dimensions of CUES (i.e., the Scholarship and Awareness scales) will be used as criteria, and the Scholastic Aptitude Test Verbal and Math means for each institution will be used as predictors. Thus, institutions that fall more than one standard error off the regression line may have relatively distinct intellectual environments. For example, in Figure 1, institution "A" has a CUES Scholarship score of 20 while institution "B" presumably has a greater intellectual "press," with a score of 25. However, according to their position relative to the regression line, institution "A" with its lower SAT input (about 1000 vs. about 1400 for "B") may well have the relatively more potent intellectual environment. On the other hand, institution "A," as well as others above the regression line, may have something else in common--students who generally tend to overrate their college. If this tends to be the case, then we would have another compelling argument for supplementing the perceptual approach to environment assessment with other less subjective measures.

Figure 1.

Regression of Mean SAT-V & M on CUES Scholarship Score



While the preceding model may control for student group differences between institutions, it does not investigate individual student interaction with the environment. Stern (1958) has measured student needs with his Activities Index, but it is not clear that the need scales are comparable to the environmental press scales measured by his College Characteristics Index. More recently, Pervin (1967) has used the semantic differential to elicit student ratings of themselves and their college. Although the semantic differential technique has been used by others in college image studies (e.g., Deutschmann, 1960), the interaction between student and college ratings has not been previously studied. It is probably fair to say that techniques to investigate student-environment interaction will and should get greater attention in the future.

Faculty Members and Administrators as Subjects in Studies of the Environment

Thus far, the discussion has centered on student-oriented measures of college environments. While revealing, studies relying only on students neglect two other important groups: faculty members and administrators. Two studies which include these two groups and which have not yet been completed might be mentioned briefly.

At the Berkeley Center for Research and Development in Higher Education, Warren Martin and his colleagues have begun a study of institutional distinctiveness using students, faculty members, and administrators. The objectives of this study include not only the identification of what is vital or distinctive about an institution, but how these qualities relate to changes in students. In addition to short-answer and open-ended questionnaires, the Berkeley study will also rely on interviews with selected samples of administrators.

A second study is being conducted by three of us in the Higher Education Research Group at ETS, Dick Peterson, Rod Hartnett, and myself, in collaboration with Earl McGrath, Director of The Institute for Higher Education, Columbia University. An instrument to measure faculty and administrator perceptions of their institutions has been devised and tentatively named the Institutional Functioning Inventory (IFI). Items in the inventory measure institutional emphases along twelve dimensions that were decided upon after six months of deliberation, soul searching, and polling of higher educators.

The twelve dimensions of institutional functioning embodied in the experimental IFI have been labeled: (1) Concern for Continuous Innovation, (2) Concern for Continuous Evaluation, (3) Concern for Continuous Planning, (4) Concern for Undergraduate Learning, (5) Concern for Advancing Knowledge, (6) Commitment to Improvement of Society, (7) Meeting Local Area Needs, (8) Institutional Esprit, (9) Democratic Governance, (10) Freedom, (11) Policy of Attracting Human Diversity, and (12) Intellectual-Aesthetic Extracurriculum.

The hope is that institutions will be able to use this inventory to examine their intended objectives against the perceptions of faculty members and administrators regarding institutional conditions and emphases. Unlike some past efforts that have mainly translated student-related CCI or CUES items for faculty members and administrators, this inventory elicits views on matters that are directed toward institutional goals and decision-making. At this time the instrument is being tested at some 64 institutions.

Why Environmental Studies

One of the questions that should eventually be discussed is the purpose of studying institutional characteristics, for presumably the particular technique used should be related to purpose. Two major utilitarian purposes are generally acknowledged. They are, first, to provide prospective students with information that will help them make a choice of colleges, i.e., the college advisement purpose; and second, to provide information for institutional self-study and reform. There is also a more basic purpose, namely the study of institutional characteristics to learn more about higher education generally, but that purpose will be circumvented in this discussion.

College Advisement for Prospective Students

This purpose assumes that a prospective college student, given the appropriate information, will choose a college best suited to his needs. The key word is, of course, "appropriate," for undoubtedly this includes both positive and negative characteristics of a college. Therefore, if this purpose is to be fulfilled, colleges must be willing to publish comprehensive descriptions of themselves, not just selected favorable features. There has not been much indication to date that many college officials are willing to do this, in spite of the fact that in the long run colleges too would probably benefit by fewer withdrawals and a more productive student body.

Pursuing the hope that colleges ultimately may be willing to publish more complete descriptions of themselves, my colleagues and I have for the past several months been working on an instrument directed at this purpose. Beginning with the premise that students enrolled at a college might best know what prospective students should know about their institution, we first interviewed students at a few geographically dispersed institutions--Duke, Berkeley, Rider, and Princeton. We asked these students open-ended questions that might give us possible item leads; for example, "As you think back over your first few months on campus, what features or events stand out?" With this information, along with what past research has suggested, we constructed a paper-and-pencil inventory in which students were asked to indicate their involvement with various activities on campus, their perceptions of the academic and social style at their institution, and finally some of their demographic characteristics. From this, we hope to present balanced descriptions of institutions and the students therein, which, together with academic prediction tables based on aptitude and grade achievement of previously enrolled students, will give prospective students a fairly complete picture of what they might expect at a college.

Institutional Self-Study

The second major purpose for environment assessment is institutional self-study. There are at least two ways in which an institution may use environment assessment in self-study. First, if periodic assessments are made, it should be possible to discern trends in environmental changes. Each assessment therefore is part of an ongoing self-evaluation, a way of monitoring progress so to speak. The second use, which is closely related to the first, argues that institutions should clearly understand the various influences within their environment so these influences may support rather than subvert institutional goals. Although some institutions may see this as a way of justifying their efforts to external bodies, such as accrediting agencies, the instruments used should also be diagnostic; they should be able to suggest changes and improvements to the institution. In a sense, then, environment assessment techniques would parallel the battery of personality tests available to the psychological counselor. Perhaps personality tests are an appropriate comparison, for just as those instruments have been questioned for their validity, so also have several of the college environment measures. As a result, there likely have been instances when faculty members and administrators merely cast doubt on the results of assessments, rather than taking steps to change the environment.

The question of validity, however, is not easily answered. Perhaps the solution is to encourage the use of many approaches. For example, in addition to the paper-and-pencil techniques already discussed, researchers might also include some of the so-called "unobtrusive measures" discussed by Webb, Campbell, Schwartz, and Sechrist (1966). This approach would advocate measuring intellectualism, for example, by recording library usage; or as a measure of faculty-student interaction, the investigator might note the number of faculty who sit with students in the cafeteria.

But then questionable validity may not always be a shortcoming of instrumentation; it may be inappropriate use of instruments. For example, Pace's College and University Environment Scales are meant to provide profiles of the total environment of an institution. Yet some researchers have attempted to use the instrument to assess the environment of a segment of an institution, such as a new experimental program. Quite likely the CUES dimensions would not be sensitive to the particular objectives of such programs.

Future Needs

In closing, it is appropriate to consider some future directions for assessment of institutional environments. Thus far, it seems that studies have concentrated on characteristics of total institutions, and certainly massive diversity among institutions has been well documented. One useful next step, it would seem, is to better describe environmental diversity within institutions, particularly the larger, multi-purpose ones. Certainly the advent of the cluster college concept, of living-learning units, and of consortium arrangements signal the need for a new look. But in addition, it may well be the subunits of an institution--both the known and unknown parts--that affect student development most crucially.

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A RESEARCH DATA BANK FOR HIGHER EDUCATION

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The purpose of this paper is to discuss the rationale and design of a large-scale program of longitudinal research on student development in higher education currently being conducted by the American Council on Education. Although the past few years have seen a great increase in the number of large-scale studies of student development in higher education, the application of the results from many of these studies has been disappointing because they have used biased, accidental (or locally available) samples of students and institutions. Moreover, many of these studies have been conducted as adjuncts to ongoing, operational programs and have generally failed to sample student behavior within the context of a large, diverse, and extremely complex higher educational system.

Our starting point in designing the Council's research program was the assumption that the principal concern of the institution of higher learning is the student, and that this concern is manifested by a purposeful attempt to produce changes in student behavior. Because we do not believe that there is a single or best method for producing change in student behavior, our research is primarily concerned with examining how changes in student behavior come about; that is, our focus is on the process of student development as it is related to the educational program. We also assumed that if the outcome of the research program was to have applied value, then the results must be derived from a sound base of longitudinal research and a national sample of colleges and universities.

The initial goal of our research program was thus to develop and maintain a comprehensive longitudinal file of information about the personal development of students attending many different types of colleges and universities. In addition to student data, the file should also contain comprehensive data concerning characteristics of the college environment. This data bank would be used in a continuing program of longitudinal research on the relative impact of different educational programs on the student's development and as a source of current, readily available descriptive information about the population of college students and of their colleges.

The general design of the research program, showing the three principal informational components in our data bank, is schematized in Figure 1. The box on the far right--outputs or criteria information--refers to the achievements, skills, attitudes, and social behavior of students that the educational program is designed to influence. The box on the far left--student input variables--refers to background characteristics, talents, aspirations, and other potentials for growth and learning that the student brings with him prior to the educational intervention. The box in the middle--the college environment--refers to those measurable characteristics of the educational institution that are capable of affecting the student outputs.

Table 1 lists some of the environmental characteristics that will be utilized in the research program. The first set of measures (under I) refer to the familiar administrative typologies used to classify institutions. The environmental variables listed under II and III were derived from a recently completed large-scale study of college environments.[1] These environmental measures resulted from a series of factor analyses of item intercorrelations obtained from student

Figure 1.

Design of A.C.E. Cooperational Research Program

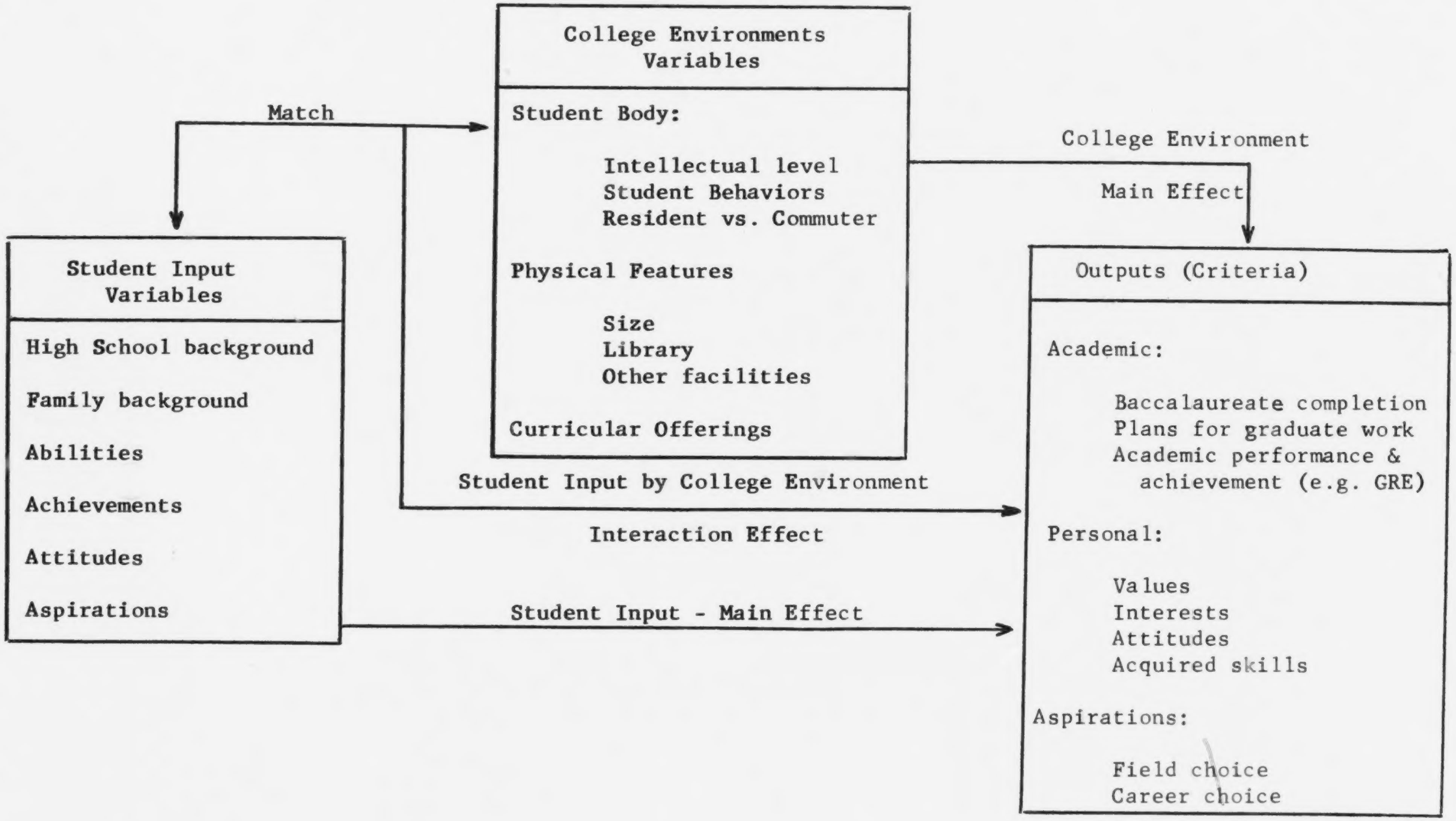


Table 1

ENVIRONMENTAL VARIABLES FOR THE ACE PROGRAM OF LONGITUDINAL RESEARCH

I. Administrative Characteristics
   - A. Sex (men's, women's, or coed)
   - B. Type (university, liberal arts college, teachers college, or technical institution)
   - C. Control (private, private-nonsectarian, Protestant or Catholic)
   - D. Geographic region
   - E. Size
   - F. Affluence or wealth
   - G. Selectivity

II. Environmental Stimulus Factors
   - A. The Peer Environment
     - 1. Competitiveness versus cooperativeness
     - 2. Arranged dating
     - 3. Independence
     - 4. Cohesiveness
     - 5. Informal dating
     - 6. Drinking versus religiousness
     - 7. Musical-artistic activities
     - 8. Femininity
     - 9. Leisure time
     - 10. Student employment
     - 11. Career indecision
     - 12. Use of automobiles
     - 13. Regularity of sleeping habits
     - 14. Use of the library
     - 15. Conflict with regulations
   - B. The Classroom Environment
     - 16. Involvement in the class
     - 17. Verbal aggression in class
     - 18. Extraversion of the instructor
     - 19. Severity of grading
     - 20. Familiarity with instructor
     - 21. Formality of the class
   - C. The Geographic Environment and Living Quarters
     - 22. Bigness
     - 23. Friendliness of the house mother
   - D. The Administrative Environment
     - 24. Severity of administrative policy against drinking
     - 25. Severity of administrative policy against sex
     - 26. Severity of administrative policy against aggression
     - 27. Severity of administrative policy against cheating

III. The College Image
   - A. Academic competitiveness
   - B. Concern for the individual
   - C. School spirit
   - D. Permissiveness
   - E. Snobbishness
   - F. Emphasis on athletics
   - G. Flexibility of the curriculum
   - H. Emphasis on social activities

responses to a 400-item questionnaire, the Inventory of College Activities. Because we believe that existing methodology and techniques for measuring differences in college environments leave considerable room for improvement, we attempted to categorize previous approaches to environmental assessment to include as many different types of information as possible in our environmental measures. Following are examples of these different sources of information:

1. Student perceptions of the college image or climate.

   This approach to measuring the college environment stems from the theoretically-based work of Stern and of Stern, Stein, and Bloom on personality assessment. In brief, the student perception approach attempts to characterize the college environment or press in terms of its potential for reinforcing or impeding certain personality needs. Examples of items using this approach are "There is a lot of group spirit" and "There is too much emphasis on getting high grades." Examples of instruments utilizing this approach are the College Characteristics Index and The College and University Environmental Scales.

2. Personal characteristics of the student body.

   This approach, represented by Astin and Holland's Environmental Assessment Technique (EAT), assumes that a major portion of the student's environment is determined by the characteristics of his fellow students. Accordingly, the environment is defined in terms of such measures as the average intelligence of the student body, the proportions of the students majoring in different fields of study, and so forth.

3. Observable student behavior.

   This approach stems from Astin's definition of an environmental stimulus as "any behavior, event, or other observable characteristic of the institution capable of changing the student's sensory input, the existence or occurrence of which can be confirmed by independent observation." In this approach, an environmental characteristic is defined in terms of the relative frequency of occurrence of a given activity or behavior, such as the amount of time spent studying or the frequency of intellectual arguments.

We believe that data derived from all three sources of information should be utilized in any attempt to characterize the college environment.

The objective in our research program is to determine how the college environment affects the student's performance. This relationship is indicated in Figure 1 by the arrow on the right which can be regarded as the main effect of the college environment on student outcomes. Figure 1 shows that student outcomes are also a function of the main effect of student input and of the interaction effect from a particular match between student and institution. That many characteristics of the college environment are closely related to student input characteristics is now well documented. That the student's abilities and aspirations when he enters college play a major role in determining what he is able to learn and the kind of person he eventually becomes is no surprise. Thus, to adequately study changes in the students as they progress through the different educational environments, it is clearly necessary to obtain input and output information from the same students over time. Only then can we introduce adequate statistical adjustments to correct for differences in student input characteristics. Although such statistical adjustments are not sufficient, they are clearly necessary before we can properly interpret any observed relationship between the college environment and student output.

So far in our research program, we have already collected considerable amounts of student input data, some student output follow-up data, and data about the college environment. Our first full-scale freshman input survey involving slightly more than a quarter of a million students entering a representative national sample of 307 accredited and nonaccredited two-year colleges, four-year colleges, and universities, was completed in the fall of 1966. A similar input survey was completed in the fall of 1967 at the same institutions, and the plans for our fall, 1968 input survey are currently underway. A one-year follow-up of the entering freshmen from our fall, 1966 survey was conducted during the summer of 1967, and we plan to conduct a one-year follow-up of the freshmen in our 1967 survey this summer. Our current plans include a complete follow-up in the winter of 1969 of students initially surveyed as entering freshmen in 1966, 1967, 1968, and 1969. This massive effort will probably be conducted under the auspices of the American Council on Education and the Carnegie Commission on the Future of Higher Education with the collaboration of Martin Trow and his colleagues at the Survey Research Center in Berkeley.

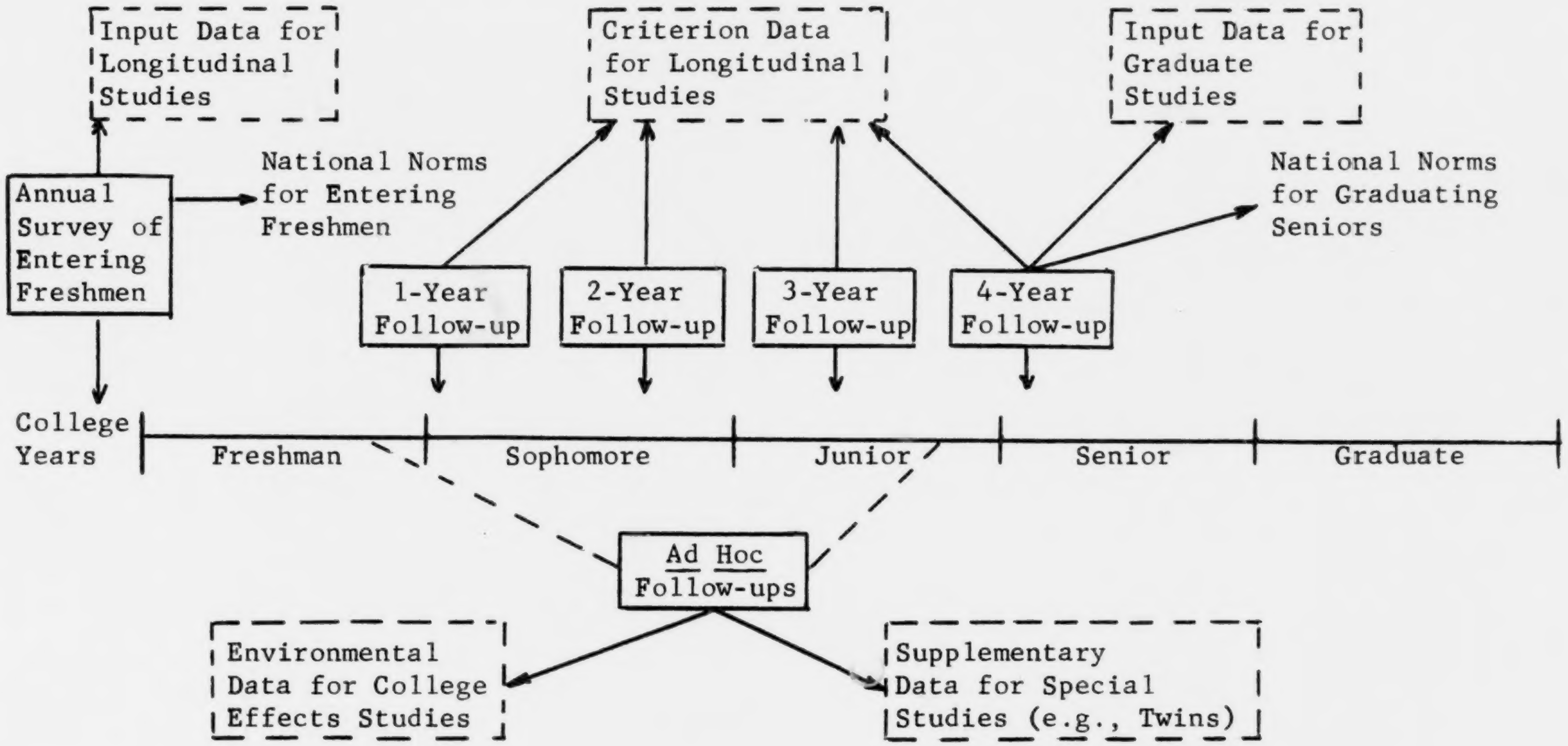
Figure 2 depicts our plans for collecting data on inputs, outputs, and college environments. The horizontal line running across the middle of the page represents a time dimension beginning on the left with matriculation and ending at some indefinite time in the future. The boxes formed by solid lines indicate different stages in the file-update process. The large box on the left, for example, represents the annual survey of entering freshmen which produces our student input data. Although the primary purpose of the annual survey is to collect input data for longitudinal studies, it produces a kind of information fallout in the form of national norms for entering freshmen which are published each fall.

Each successive freshman survey provides input data for an independent population of students. Thus, to cover the widest possible range of student outcomes, the Freshman Information Form is newly designed each year. We do, however, maintain a core of basic biographical and demographic items which are repeated verbatim annually to obtain comparable data for monitoring trends over time in the characteristics of students entering different kinds of institutions. However, much of the content of the form--representing the more research-oriented input items--is flexible so that we can pursue promising research leads in greater depth and explore the potential of new ideas, hypotheses, and techniques. The "basic" core of items currently include such variables as: sex, age, overall high school grade average, level of educational aspiration, selected high school achievements, racial background, parents' level of education, parental family income, religious background and preference, birthplace and parents' birthplace, probable major field of study, probable career occupation, and parents' occupation.

A major goal of our research program is to make the Council's data files available to investigators who wish to have special tabulations prepared and to researchers who wish to conduct studies utilizing the data bank as a base. To achieve this goal, the Council has committed a generous amount of financing on a

Figure 2.

Schedule of Data Collection for the ACE Program of Longitudinal Research


Input Data for Longitudinal Studies
Criterion Data for Longitudinal Studies
Input Data for Graduate Studies
Annual Survey of Entering Freshmen
National Norms for Entering Freshmen
National Norms for Graduating Seniors
1-Year Follow-up
2-Year Follow-up
3-Year Follow-up
4-Year Follow-up
College Years
Freshman
Sophomore
Junior
Senior
Graduate
Ad Hoc Follow-ups
Environmental Data for College Effects Studies
Supplementary Data for Special Studies (e.g., Twins)

risk-capital basis to the development of a computer software system for outside users to have ready access to the data files. Our goal in designing this accessible system has been to develop an efficient, reliable, and rapid service for the social scientist, assuming no prerequisite background on the part of the user with regard to computers and programming. In brief, our goal was to provide an efficient analytical control language for the user that would provide him access to the data bank and manipulate any variables of interest in "natural" language. For example, the user should be able to specify merely that he would like to have a cross-tabulation of income by grades by sex for those students in the 1966 survey who had frequently participated in organized demonstrations during their senior year in high school. We hope to have such a system operational by June of 1968.

We believe that the data bank has many other potential uses for cooperative and collaborative research. For example, participating institutions have an option to obtain from the Council a complete item-response file of their students' data. Over 100 of the participating institutions in the fall, 1967 survey have obtained copies of their students' item responses. The potential for in-depth institutional self-study utilizing these files is apparent. Another cooperative application of the data bank currently underway is a computer link-up of the ACE 1967 freshman data with the files of the National Merit Scholarship Corporation. The ACE files will be updated with test-score information, and the NMSC files will be updated with information concerning the student's college of matriculation. Also, as I have indicated earlier, the Council is currently exploring the possibility of collaborative efforts with regard to the Carnegie Commissions' Study of the Future of Higher Education. In addition to sharing student follow-up data from the Council's data bank, we intend to make our institutional data files available for the Carnegie study, and the data base or institutional sampling frame developed in our research program will be utilized in sampling faculty and graduate student behavior. These data will also eventually become available through the Council's data bank.

In summary, the contribution that the Council's data bank--and the studies growing out of it--could make to higher education are impressive. It is our hope that the design and flexibility of our research program and the studies performed and planned so far constitute a firm forward step in realizing these possibilities.

Footnotes

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BUDGET FORMULAS AND MODEL BUILDING

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Budget formulas are becoming increasingly important in higher education. This paper describes selected budget formulas currently used by states with system-wide coordinating boards. The descriptions, rather than being exhaustive, are intended to give examples of developments in this area as a background for examining a budgetary model. The model gives a conceptual framework for the integration of these formulas. Because of the limitations of formulas the model is recommended as a device to replace these formulas.

Procedure

Data were obtained during February and March, 1968 from the twenty-seven coordinating boards identified by Williams (1967) as having, among other functions, that of budgetary review. Each board provided documents describing the formulas, if any, used in the preparation of consolidated budget requests. The descriptions were taken from these documents. To guarantee the confidentiality of the response, specific states are not identified.

In selecting the states and formulas to concentrate upon, it was decided not to emphasize those states that are already adequately described in the literature (Miller, 1964; WICHE, 1959). Furthermore, to give focus to this presentation, the discussion is limited to formulas relative to university operation. Some states justify different formulas for different segments (universities, colleges) of the system. However, by examining the more complex university-level formulas, judgements can be made about appropriate formulas for the other, less complex, segments in higher education.

To stress the type of formula the examples are presented by function (library, maintenance) rather than by the customary category of state. And the focus will be on the common elements of operation, rather than special programs: museums, colleges of medicine, schools for the handicapped, and so on. These formulas should generally be thought of as request formulas rather than appropriation formulas since they are administered for the most part by the coordinating boards in making representation before state officials on behalf of the institutions. And finally, it cannot be overly stressed that because of the marked differences of practice concerning the definitions and procedures employed among states, any figures or ratios must be interpreted only as guidelines to informed judgement.

Staffing

The most common formula relates faculty positions in some way to the number of students. Table 1 illustrates the ratio of students per faculty position at four levels of instruction for the eight coordinating boards whose data were already in or could be interpreted to be student-faculty ratios. The numbers in the table represent students-per-faculty position. These data indicate that there is substantial agreement among states with recommended student-faculty ratios of about: 23:1 lower division, 17:1 upper division, 12:1 masters, and 6:1 doctoral.

162/163

Table 1

FTE STUDENT ENROLLMENT REQUIRED PER FACULTY POSITION

State	Levels of Instruction Lower Division	Upper Division	Masters	Doctoral
A	20	12	7	5
B	24	16	12	6
C	28	20	8	
D	26	16	8	
E	22	18	12	6
F	20	15	12	6
G	25	18	8	
H	22	18	12	6
Range	20-28	12-20	7-12	5-6
Mdn	23	17	*	*

* Insufficient data

These data can be translated into credit-hour, class-size, and teaching-load figures by the application of program assumptions. For example, state A's lower-division ratio of twenty students to one faculty position assumes an average of twenty-five students per class and twelve class hours per faculty member, resulting in 300 student credit hours (25 x 12 = 300). The ratio of students to faculty will, obviously, depend on assumptions of faculty service (work load).

Other staffing formulas cannot be summarized as easily. A coordinating board in an eastern state recommends the following standards for support personnel: (a) two clerical positions for each dean's office, (b) one clerical position for each department chairman, (c) one clerical position for each four faculty members, and (d) one laboratory assistant for each fifty laboratory student stations.

Another coordinating board (southern) recommends one administrative position to 7.3 teaching positions, and other nonacademic positions at the rate of one to ten academic positions. A second southern board recommends a university-wide ratio of one nonfaculty position per three faculty. Neither board offers clear definitions of what constitutes a nonacademic position. Does it include student help, technicians, deans?

These boards are, however, unusual in their detailed specifications. The majority of documents do not purport to be able to identify the appropriate numbers of support personnel that are necessary. Instead, dollar amounts, usually as a percentage of a base instructional cost are identified for such "overhead" items as personal (i.e., clerical, teaching, and laboratory assistance), departmental, central administration, or student personnel services. Specific positions, especially administrative, are determined through means of representation other than the budget request.

Salaries

Most salary requests are related to the academic market, either regionally or nationally. An illustration of the first approach is a midwestern state that has adopted a "3rd place concept":

> Salaries paid to professors, associate professors, assistant professors, and instructors in the various colleges of the universities are secured and ranked from high to low. The institutions feel that they can be competitive if their salaries can be at a point midway in the upper half of the ranking by college and rank. Using this approach, each institution computes its needs for academic salary increases on the basis of its current salaries compared with the 3rd place salaries in the 11-state area. This calculation includes the amount needed to get to 3rd place, and stay there during the next biennium....

The second approach is illustrated by a coordinating board in one of the states with a high per capita income. This board recommends "target salaries" that are based upon the midpoint between the "A" and "AA" on the AAUP compensation scales, plus fringe benefits at 8 percent of salary. Table 2 illustrates this board's target salaries (not including compensation) by rank and the related AAUP salary midpoints, which include compensation.

Table 2

TARGET AVERAGE SALARIES 1968-69 THROUGH 1970-71

	1968-69		1969-70		1970-71	
Rank	AAUP "A"-"AA" Midpoint	Target Salary	AAUP "A"-"AA" Midpoint	Target Salary	AAUP "A"-"AA" Midpoint	Target Salary
Professor	$24,250	22,454	25,397	23,516	26,598	24,628
Assoc. Professor	14,500	13,426	14,842	13,743	15,192	14,067
Ass't. Professor	11,350	10,509	11,765	10,894	12,195	11,292
Instructor	8,650	8,009	8,994	8,328	9,351	8,658

Libraries

This major budget item, usually separately identified, is being justified increasingly by detailed quantitative methods (McAnally, 1963). Instead of the more conventional, but somewhat arbitrary, Russell-Doi percentile breakdowns or rates per credit hour, a substantial number of state coordinating boards are adopting the guidelines of the Clapp-Jordan formula because it includes such elements as faculty size, number of students, and the numbers and nature of fields of study offered at various undergraduate, graduate, and professional levels of instruction. The formula is a study in itself and the reader is referred to Clapp and Jordan (1965) for details.

Maintenance

Guidelines or formulas for maintenance are always related to either gross square or gross cubic footage. The definition of maintenance varies substantially and thus comparisons are nearly impossible. There are, however, certain figures that are repeated from state to state and seem to have reasonable validity. When maintenance is defined as custodial work, a cost per square foot of between \$.18 and \$.25 tends to emerge with relative consistency; when, however, the definition of maintenance involves more than custodial care but is related to repairs and renovation or operation (heating, lighting), then the cost per square foot or cubic foot is most often between \$.90 and \$1.50. These are, at best, rules of thumb.

Institutional Complexity

Several states have studies, are studying, and have applied weightings or factors to levels of instruction, often by areas of knowledge, to give additional weight to budgetary requests from institutions with, for example, proportionately larger graduate programs. The most detailed of these formulas, used to request funds for organized research, is from one of the western states:

$$IC = \frac{.015U + (.50M_1 + .10M_2 + .25M_3) + (6D_1 + 1D_2 + 3D_3)}{U + M + D}$$

where:

IC = Institutional Complexity
U = Undergraduate FTSE
M = Masters FTSE
    M_1 = Masters FTSE in Science and Engineering
    M_2 = Masters FTSE in Teacher Education
    M_3 = Masters FTSE in all other programs

D = Doctoral FTSE
    D_1 = Doctoral FTSE in Science and Engineering
    D_2 = Doctoral FTSE in Teacher Education
    D_3 = Doctoral FTSE in all other programs

FTSE = Full Time Student Equivalent

Several states use similar factor weights, largely reflecting faculty workload by levels of instruction; these factors are used for purposes ranging from determining merit pay (by rank) to allocating general instructional costs.

Table 3 illustrates factor weights from three states. It seems to be generally true that a ratio of about 1:3 exists between the lower division and graduate programs. Another way of looking at this ratio is to say, for example, that each unit of a resource required per student credit hour at the lower division level will require three units at the graduate level.

Table 3

FACTOR WEIGHTS BY LEVEL OF INSTRUCTION IN THREE STATES

Levels of Instruction	A	B	C
Lower Division	1.00	1.00	1.00
Upper Division	1.50	1.60	1.50
Graduate Professional Masters, and First Stage Doctoral	2.50	2.57	3.00
Doctoral, Second Stage	3.50	3.45	

Limitations in the Use of Formulas

These formulas at best serve as rough guides to existing quantitative relationships. They do not, of course, recognize even subtle variations that exist among areas of study or institutions. They are only meaningful when related to other information; and they do not serve as ultimate criteria, only as norms. There is a danger that formulas will be accepted, without question, no matter how bad, because of superficial validity. And after acceptance, the experience has been that they grow continually more rigid and detailed. Furthermore, in all approaches to request and appropriation formulas there is always the danger that those aspects of higher education necessary to the creation and maintenance of the complete intellectual environment will be omitted from the formula--items such as museums, art collections, counseling, faculty research, and so on.

Some feel the formulas, at best, merely bring confusion out of chaos. Some of this confusion can be reduced by the use of common, or at least more complete definitions. Recommended are the detailed definitions worked out in two states: Illinois Board of Higher Education (1966) and Coordinating Board, Texas College and University system (1966). Interstate studies providing guidelines to appropriate definitions are Miller (1964) and Swanson, Arden, and Still (1966). Complete citations are listed with the references.

Another way of reducing the confusion is to integrate the usually discrete and unconnected formulas. This can be accomplished through a model that simulates the instructional process. Table 4 suggests that the required resources are a function of the level of instruction and the area of knowledge, i.e., the

Table 4

THE APPLICATION OF RESOURCES ACCORDING TO AREAS OF KNOWLEDGE AND LEVELS OF INSTRUCTION

Areas of Knowledge (Selected)	Levels of Instruction			
	Lower Division	Upper Division	Masters Degree	Ph.D. M.D.
Biological Sciences				
Physical Science				
Social Sciences	"A"	"B"		
Humanities				
Fine Arts				

application of resources (laboratories, library, faculty, maintenance) depends upon the area of knowledge under consideration and the level of teaching. Each cell encompasses a relationship between a level of instruction and an area of knowledge. These cells are the important aspect of the matrix because within each cell a model can be built to describe the deployment and cost of resources necessary to operate an instructional program at the "intersection" of knowledge and instruction. Take the lower-division social sciences as a first example (Cell A). Table 5 illustrates the resources necessary for 1000 students.

Table 5

DETAIL FOR CELL A

Departmental Instruction and Research	
a. Faculty Compensation	$378,000
Faculty Load: 360 student credit hours Student Load: 15 credit hours Total Student Credit Hours: 15,000 Total Faculty Required: 42 Average Faculty Compensation: $9,000	
b. Faculty Support	94,500
Personal Services: $40,000 Supplies and Other: $44,500 Departmental Administration: $10,000	
	$472,500
Instructional Services ($30 per student)	30,000
Libraries (10% of departmental instruction)	47,250
Student Services ($80 per student)	80,000
General Expense ($45 per student)	45,000
Plant Operation ($100 per student)	100,000
Administration ($45 per student)	45,000
Total, Instructional and General Expenditure	$819,750

Compare the model of Cell A with Cell B, upper-division social sciences. In Cell B, assume a higher average faculty compensation because these are for the most part higher ranked faculty, thus higher salary. Classes will be smaller; therefore, more faculty are necessary. And other expenses are, likewise, higher. The result is that the deployment of resources (e.g., faculty) change from cell to cell, resulting in a different model for each relationship. The total instructional program can in this way be simulated cell by cell.

Table 6

DETAIL FOR CELL B

Departmental Instruction and Research	
a. Faculty Compensation	$787,500
Faculty Load: 240 student credit hours	
Student Load: 15 credit hours	
Total Student Credit Hours: 15,000	
Total Faculty Required: 63	
Average Faculty Compensation: $12,500	
b. Faculty Support	202,500
Personal Services: $80,000	
Supplies and Other: $90,000	
Departmental Administration: $32,500	
	$990,000
Instructional Services ($30 per student)	30,000
Libraries (10% of departmental instruction)	100,000
Student Services ($80 per student)	80,000
General Expense ($45 per student)	45,000
Plant Operation ($200 per student)	200,000
Administration ($45 per student)	45,000
Total, Instructional and General Expenditure	$1,490,000

The major benefit of the model approach seems to be a meaningful integration of data. These data are in the form of a program which identifies the allocation of resources as a total package, rather than as separate parts: the model versus the formula. An additional benefit is that the model may be more amenable to the techniques of program budgeting than are formulas. These suggestions may indicate the usefulness of such exploration.

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FINANCIAL ASPECTS OF INTERINSTITUTIONAL COOPERATION: UNIT COSTS IN CLUSTER AND NON-CLUSTER COLLEGES

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INTRODUCTION AND STATEMENT OF THE PROBLEM

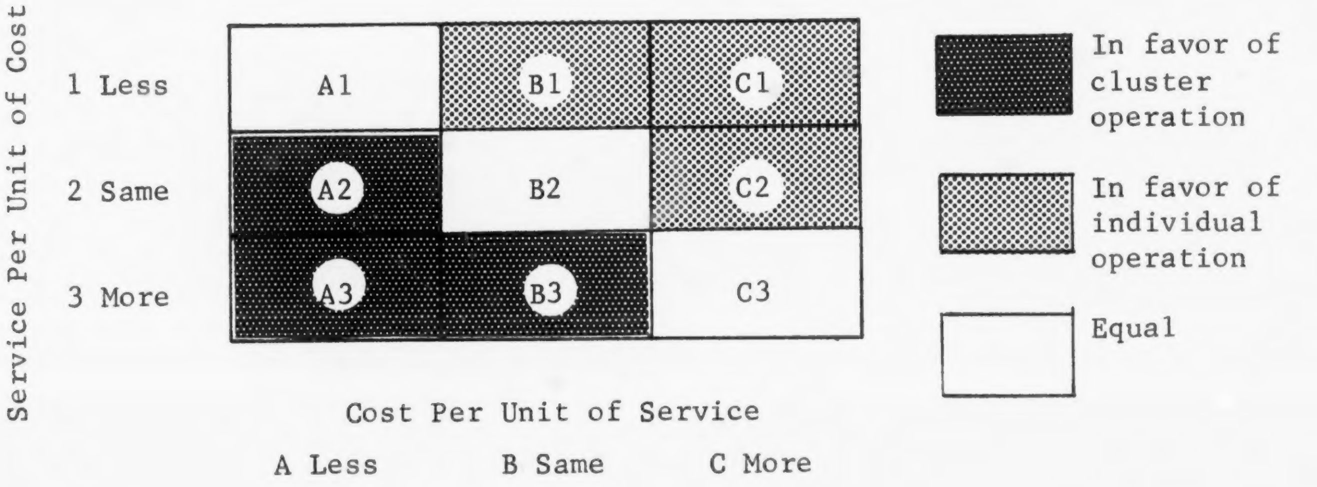
The Claremont Colleges in 1925 started the first cluster college experiment in this country. The idea was to preserve the personal values of the small college while securing the facilities of the university and to enrich educational resources at a faster rate than the rise in unit cost. The cluster concept has achieved the first of these objectives, but we do not know the cost. As Seymour Harris points out, "part of the failure to pay more attention to college costs is due to a widespread view that the measurement of these costs is impossible."[1] Yet, these costs must be identified. It is extremely important for a college to make sure that the most is being gained from each dollar spent.

Cost comparisons should be useful to all colleges, and since some cluster groups are now being proposed for reasons of economy, the Claremont Colleges should be a logical choice for comparison of costs of certain of their facilities or functions which operate on a cooperative or central basis within the cluster to the costs of similar functions in individual independent colleges (i.e., those which are not part of a cluster or group of cooperating colleges).

The relationship between costs and services may be represented as shown in Figure 1.

Figure 1.

Cost/Service Relationships



The assumption is that certain cluster college operations are more economical than individual college operations and should therefore fall into categories A2 (less cost for the same services), A3 (less cost for more services), or B3 (same cost for more services). Categories B1, C1 and C2 would represent cost or service disadvantages, and the diagonal A1, B2, C3 would show no advantage either way assuming that the less or more services are paralleled by equivalent less or more costs (i.e., a constant per-unit reduction or increase).

In the Claremont group there are five undergraduate colleges (Pomona, Scripps, Claremont Men's, Harvey Mudd, and Pitzer) and the Claremont Graduate School. Four of the colleges were included in the current study. Pitzer, a women's college, admitted its first students in 1964, and no comparable group of independent colleges could be found for comparison purposes. Claremont Graduate School was not included because it is a quite different organization from most graduate schools and because it did not, for the period covered by the study, participate in all the cooperative functions examined. When information is presented concerning the Claremont Colleges as a group, however, data for Pitzer and the Graduate School are included.

Method and Procedure

A list of colleges was compiled for comparison with each of the four Claremont Colleges to be included in the study. Factors considered were enrollment, annual expenditures, academic reputation, selectivity, faculty compensation level, assets, endowment, tuition, sex, and curricular emphasis.

For Pomona, coeducational liberal arts colleges were used; for Scripps, women's colleges; for Claremont Men's College, men's colleges; and for Harvey Mudd, colleges of science and engineering. Dartmouth was used as a comparison college for the Claremont Colleges as a group. Clearly, no two colleges will be completely comparable on all the variables mentioned above. An attempt was made to match colleges as closely as possible on the variables involved.

From an initial list of approximately 50 colleges, 18 were finally selected for use in the study. The most difficult selection was for Harvey Mudd College, and only two colleges were chosen for comparison purposes. For each of the other Claremont Colleges, 5 colleges were chosen for the comparison group. The colleges in each group are listed in Table 1.

For discussion purposes, the colleges i[illegible]he comparison group for Pomona will be referred to as "Coeducational Colleges"; [illegible]se for Scripps, as "Women's Colleges"; for Claremont Men's (CMC), as "Men's Colleges"; and for Harvey Mudd (HMC), as "Engineering Colleges." "The Claremont Colleges" (CC's) refers to all five undergraduate colleges plus the Claremont Graduate School. There are 19 areas of cooperation in which all six Claremont Colleges participate. There are 16 other areas in which two or more colleges are involved. Only seven areas of interinstitutional cooperation currently existing among the Claremont Colleges were selected to be studied. I shall report the three of these--library, business office, and health services--for which the most information was available. The attempt was made to measure both costs and services, but no judgment of the quality of the services received at the infirmary nor of the quality of the holdings of or services rendered through the library was made, for example, although some judgments of this general type were implicit in the selection of the institutions to be included in the study.

Table 1

CLAREMONT COLLEGES AND CHOSEN COMPARATIVE COLLEGES

Claremont Colleges	Colleges in Comparison Group
Claremont Men's	Hamilton Haverford Kenyon Wabash Washington and Jefferson
Harvey Mudd	Cooper Union Rose Polytechnic
Pomona	Colorado Knox Occidental Reed Swarthmore
Scripps	Barnard Bennington Chatham Goucher Mills
The Claremont Colleges (as a group)	Dartmouth

To make initial comparisons of the areas listed above financial reports of all the colleges in the study were obtained. Anyone who has dealt with college annual financial reports will probably agree with McGeorge Bundy who said:

> Even on relatively straightforward questions of financial reporting, most of us are still remarkably reticent. The annual financial report of the average institution of higher learning is comprehensible only to its writer, if to him. Let me emphasize here with all the force I can, that I charge no one with fraud or even with negligence. The reasons for the deficiencies in our accounting are many, but in my judgment they do not include weakness of mind or conscience among our administrators. They are more subtle and more difficult than that.[2]

He further states:

> Above all--and I think this is my central point--complexity is no excuse for obscurity. The educational meaning of our financial facts and figures may sometimes be arbitrary or indeterminate, but the facts and figures exist and they need to be more openly and fully reported than they are.[3]

Because of the intricacies of financial reporting the chief financial officer of each college in the study was contacted to secure his cooperation. In every case the willingness to participate met or exceeded expectations.

After the financial reports had been received and initial comparisons made, each college was visited to examine the data with the chief financial officer and to discuss appropriate areas under study with other college staff members as required.

The decision concerning the specific functions or activities to include in each category (library, health services) was reached after much discussion with these persons. Their judgment of the best way to distribute costs in each case for their own college, based on the distribution of personnel time and the functions performed by individuals and offices, identified costs more accurately than otherwise would have been possible. A pilot study of the analysis of expenditures of medical education at Emory University concludes:

> Cost analysis, no matter what system is used, is not an exact science but, rather like medicine, an art based upon a science. . . . Judgment must be used in such matters as determining how to distribute each overhead cost most equitably and develop the best estimates for the distribution of personnel time, determining where the exceptions to the established rules are justified, or perhaps in considering the relationship of the purpose of an expenditure to the method of distribution. Obviously, these judgments must be based upon a familiarity with the general philosophy of the enterprise under study. These judgments should be supported by reason, and reason, of course, is frequently debatable.[4]

In some comparisons, if data were not available for three years, estimates were used if they could be made reliably. If data were unavailable or there was no way to get a reliable estimate or costs could not be allocated accurately, that college or group was omitted from the comparison. In some cases data for the individual Claremont Colleges are shown. Where costs or services are the same for each college, or where records are not separated by college, only the information for the Claremont Colleges as a group is shown.

Discussion and Results

Each area included in the study will be considered separately. For each area studied an attempt was made to identify meaningful cost and service (or resources) measures. A description of the costs for each area is given as well as a description of the duties, services, or resources related to those costs.

Library

Library costs can be divided generally into two categories: (1) those concerned with the operation of the library, and (2) those allocated directly for book purchases. (When referring to (1) above I will use the word "cost," and when referring to (2) I will use the phrase, "expenditures for books.") Cost of operation of the library includes all salaries and fringe benefits, supplies and expense, but does not include grounds expenses, building maintenance, amortization, or utilities.

The cost per student in the comparison colleges decreases as the size of the student body increases, at least up to about one thousand. The trend then reverses and moves upward to the Coed Colleges and to Dartmouth.

Among the Claremont Colleges, Harvey Mudd shows a high cost per student partially because of the relatively small enrollment. Scripps College's high cost results from the Denison Library, which is a separate library owned and paid for entirely by Scripps.

The cost per student for the operation of the library for the Claremont Colleges is $97. This cost is below two of the four comparison groups, the one with the smallest enrollment (Men) and the one with the largest enrollment (Coed).

In terms of resources and services, what is available for the costs referred to above? One measure of the resources available to the students is Volumes per Student (books, micro editions, bound journals and serials, excluding documents). For services available I have chosen three that can be measured fairly objectively; Volumes Circulated per Student, Interlibrary Loans per Student, and Hours the Library is Open per Year.

When volumes per student are examined the same pattern for the outside comparison groups is noted as in the cost of operation per student. When cost per student is plotted against volumes per student, a very strong positive relationship is seen; the greater costs are accompanied by greater resources available to the students. Dartmouth's costs are proportionately higher than the other colleges. Analysis also shows that higher costs are generally associated with more service in terms of hours the library is open each year.

No relationship between cost and number of volumes circulated per student was found. We could reasonably expect a relationship between the two since number of volumes circulated per student would be a service measure, i.e., reflect activity level for the library staff. However, the number of volumes circulated will be determined by a number of factors, such as adequacy of reading rooms in the library, circulation policy, whether stacks are open or closed, reserve book policy, size and adequacy of the library collection, as well as nature of the student body. It should also be mentioned that there is no relationship between the number of volumes circulated per student and either the number of volumes per student or the number of students.

In the comparisons thus far, the Claremont Colleges have been at about the mid-point on cost per student as well as on the variables of volumes per student, volumes circulated per student, and hours open per year.

Turning from the cost of operation of the library to expenditures for books, we have found decreasing per student expenditures as enrollment increases beyond 1000, then a reversal of the trend. It is interesting to note that the expenditures for books per student exactly parallels the measure of total number of volumes in the collection of the college or group of colleges represented. For example, Dartmouth has the largest collection. The Claremont Colleges have the second largest library collection, followed by the Coed Colleges, Men's Colleges, Women's Colleges, and Engineering Colleges, respectively. Therefore we see that current practices, i.e., expenditures for books over the most recent three year period, accurately identifies the relative size of the total library collection. This relationship of course, does not necessarily have to be the case, and it is surprising that it holds, given the different ages of the various colleges involved in the study.

Table 2 shows in a simplified form some of the relationships discussed earlier, plus a few new ones. The first two items show a general increase in the

Table 2

RELATIVE POSITION OF THE CLAREMONT COLLEGES AS A GROUP AND COMPARISON COLLEGES ON LIBRARY MEASURES

1. Cost per student	DRT	MEN	COED	CC's	WOMEN	ENGR
2. Volumes per student	MEN	DRT	COED	CC's	WOMEN	ENGR
3. Expenditures for books per student	DRT	CC's	COED	MEN	WOMEN	ENGR
4. Number of Volumes	DRT	CC's	COED	MEN	WOMEN	ENGR
5. Cost of operation	DRT	CC's	COED	MEN	WOMEN	ENGR
6. Expenditures for Books	DRT	CC's	COED	WOMEN	MEN	ENGR
7. Number of Interlibrary loans per student	DRT	MEN	COED	CC's	WOMEN	*
8. Hours Library open per year	COED	MEN	DRT	WOMEN	CC's	ENGR
9. Volumes Circulated per student	COED	WOMEN	DRT	CC's	ENGR	MEN

* Insufficient information for Engr. Colleges

number of volumes per student as the cost per student increases. Item 5, the total cost of operation of the library, follows the same pattern as the immediately preceeding items, as does item 6, Expenditures for Books, with the one reversal of the Men's and Women's colleges. However, the difference in total expenditures for books over a 3-year period for these two groups of colleges averages less than $500.

Item 7 is a service measure, and for the colleges for which information was available, the pattern follows the cost per student. Item 8, another service measure, follows another pattern, but the differences between groups are in most cases small. Item 9, still another service measure, was not related to cost per student, nor to volumes per student.

In terms of cost, the Claremont Colleges as a group have no advantage that a university or a college the same size as the total group would not have, i.e., they fall in line in the expected places for both costs and services.

Considering the individual colleges, Scripps and HMC show higher per student costs than their comparison groups but also have only one half and one third the enrollment, respectively. Pomona and CMC are slightly smaller than their comparison groups, but show less per student costs.

In Table 2 the per student costs and overall costs tend to parallel the measures of resources and services, showing generally that you get what you pay for.

From the point of view of each individual college in the cluster, however, it is at the service level of the group for the per student cost of the group, thereby achieving a cost advantage compared to individual operation.

A word should be said about the increase in per student costs when colleges exceed a certain size. Perhaps when libraries reach a certain size, increasing emphasis is placed on special collections, rare books, and out-of-print editions. This would increase the cost of book purchases per volume, while lowering the volumes per student and very likely increasing the cost per student. This same type of reversal of cost per student for the larger colleges will be noted in some of the other areas studied.

Business Office

The Business Office for the Claremont Colleges charges for services on the basis of a formula which weighs equally total assets, endowment, tuition and fees, income, and total annual expenditures of the colleges involved. These items, which overlap considerably, are believed by the presidents and treasurers to represent fairly accurately the costs incurred by the business office for handling the financial affairs of each college. The amounts of these four items are added together for each college, and that total as a percent of the totals of all the colleges represents the individual college's share of the business office expense (with some slight modifications for various types of trust deed loans). The amount paid was considered in this study to be the cost of operation of the business office for that college. For all colleges included in this study the same four factors were used. Because of the overlap of the categories the amounts listed as "dollars handled" are, of course, larger in every case than the actual dollars handled by the respective business offices. For the same reason, the "cost per thousand dollars handled" will be lower than actual in each case. Therefore, the dollar amounts per se are not important, but rather the relative positions of the colleges.

The functions on which cost of operation of the business offices was based are as follows: personnel processing and records, payroll, bursar (including student payments, scholarships, loans, tuition, fees, gifts, group insurance, and TIAA), general accounting, budget control, treasurer's office (investment administration, annuities, life income and endowment). Costs of maintenance, amortization, and utilities have been excluded.

Except for the Men's Colleges, the Comparison groups show decreasing unit costs as enrollment increases. When the cost per thousand dollars handled is plotted against total dollars handled all of the comparison colleges fall into a pattern of decreasing unit costs with increasing volume of money handled. It seems that activity level or dollars handled is closely associated with cost, i.e., the size or volume in terms of dollars handled is more important than the size of the college in terms of enrollment.

Three of the four Claremont Colleges show essentially the same costs, with Scripps being lower than the others. The costs for these colleges should be quite similar since all are charged on the basis of dollars handled, as mentioned before, with some differential charges for handling trust deed loans.

Each Claremont College, and therefore the Claremont Colleges as a group, shows lower costs than any of the comparison groups. Three of the four are quite low in terms of dollars handled, but this is not translated into high costs, probably because they are part of a larger business operation.

There may be some reason to examine the rationale for the method of computing charges for business office services within the Claremont Colleges (e.g., does it really cost as much to handle $1000 of endowment as it does to handle $1000 of tuition and fees?). But, overall the central operation appears to have a financial advantage over the individually operated college business office.

Health Services

Since there are no health services at Cooper Union, the HMC-Engineering group has been omitted from the comparisons. At the Claremont Colleges, records of treatment are not separated by the college of the student, and therefore information concerning the individual colleges is not shown--but only that for the group.

The cost of the health services includes all salaries and fringe benefits, equipment, office and medical supplies, and expense but excludes maintenance, amortization, and utilities. The cost per student varies only slightly among the various groups in the study. The Coed colleges and Claremont Colleges are the two larger of the four groups and have the lower unit costs.

As a service measure, the availability of doctors during the year, i.e., total doctor duty hours per student, was used. This is the total number of hours all doctors were on duty during the academic year (36 weeks), divided by the number of students. One might expect the Coed colleges and Claremont Colleges to have the lowest ratio by this measure to correspond with the lower unit costs, but only the Coed colleges are noticeably low in this regard. The doctor duty hours per student range from .25 hours for the Coed colleges to .71 for Men's colleges, .90 for the Claremont Colleges, and .95 for Women's colleges. Typically, the health services of the colleges in this study were administered by part-time doctors, who spent approximately two hours per day, five days per week, on the college campus, during which time they treated out-patients and made infirmary rounds. The doctors were on call 24 hours per day, seven days per week. There was, however, considerable variation in the staffing of the health services, a situation generally reflected in the cost per student figures.

A measure of the use of the health services is number of visits per student. This ranges from 4.9 at the Claremont Colleges through 5.2 for Women's Colleges and 5.4 for Men's Colleges to 6.3 for the Coed Colleges. The high number of visits per student for the Coed colleges, coupled with the low doctor duty hours per student, indicates that the doctor duty hours per visit would be quite low and suggests that in these colleges proportionately more of the visits are handled by the nurses. The Claremont Colleges with .9 doctor hours available per student achieves the low unit cost through the larger total enrollment.

The cost per visit to the health services varies from a low of $4.73 (Coed Colleges) to $6.30 (Claremont Colleges), $7.11 (Men's Colleges), and $8.49 (Women's Colleges). In this measure the colleges fall in the same order as on cost per student.

Students typically pay for health services on a per-student basis (health fee), rather than by the visit; and on this basis (cost per student), the larger numbers and lower unit costs go together. In the case of the Claremont Colleges this low cost is associated with high service in terms of doctor duty hours per student.

For health services, then, it seems that a larger combined center does provide cost benefits.

Summary and Conclusions

The purpose of this study was to examine the costs of certain functions in cluster and noncluster colleges. For the areas studied, it seems that the cluster colleges do achieve lower unit costs than individual noncluster colleges, while maintaining the services and resources associated with larger size. It also must be said, however, that a much clearer picture of the operations of both cluster and noncluster colleges is needed. It was very difficult to get comparable information from all of the colleges involved in this study (18 comparison colleges plus 6 Claremont Colleges). Apart from the problem of colleges keeping books in different ways, is the problem of simply not having information readily available. Available information in comparable form would allow meaningful comparisons to be made between colleges with relative ease.

More extensive studies need to be conducted in this area and should include more clusters of colleges, a wider range of independent (noncluster) colleges, plus state and church related institutions. We should also work toward the development of meaningful cost and service measures. The measures used in this study may or may not prove to be useful, or they may help to point out what kinds of measures are most meaningful.

The general tendencies found in this study--a decrease in unit costs as enrollment increases up to 1000 or 1100 and then an increase in unit costs accompanied by increases in services and resources--may not hold for other cluster and noncluster colleges. We also must determine what high unit costs mean--are they "good" or "bad"? They seem to have different meanings depending on the size of the college, i.e., they may reflect a low or a high level of services and resources. Certainly with the number of college mergers taking place today and the increases in the cluster type of operation, these questions must be answered.

Footnotes

1. E. Harris Seymour, Higher Education: Resources and Finance, New York, 1962, p. 502.

2. McGeorge Bundy, speech delivered to the American Council on Education, Washington, D. C., October 13, 1967.

3. Ibid.

4. Cited in Harris, pp. 502-503.

PROGRAM BUDGETING: A CASE STUDY IN ITS APPLICATION

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A program budget brings into focus the allocation of resources (staff, space, equipment) to each and all major programs of an institution, which in turn promote its purposes and objectives. As such, a program budget must start with the delineation of the major goals and objectives of the institution. Specific programs can then be evaluated in terms of their contribution toward those objectives. These programs command resources which in any organization never exist in adequate supply to satisfy the many needs that institutions seem to have. The goals of the institution need to be established and given some order; the various programs contribute toward achieving these goals in light of the resources which these programs command; and given resources used in alternative ways make a given contribution toward these objectives. Program budgeting brings to focus a "rational choice of feasible ends, allocation of means, monitoring of progress, and appraisal of results."

Comparison of Conventional Budgeting and Program Budgeting

Most college and university accounting systems are concerned with the legal and fiduciary responsibilities connected with the receipt and expenditure of funds. The accounting division of the institution is therefore concerned primarily with keeping detailed records on the following: (1) sources of funds; (2) restrictions on receipts and expenditure of funds such as scholarship funds, research funds, earmarked endowment funds; and (3) aggregates of expenditures on instruction, organized research, organized activities relating to departments, extension and public service, auxiliary enterprises. In addition, one finds conventional accounting and budgeting procedures that: (1) develop average cost ratios; (2) have short time dimensions--accounting for the current year and budgeting for the next two years at most; (3) are purely fiscal--the major effort is to record the sources of funds and how they are spent; and (4) build expenditure budgets on the line item entries already in existence allocating funds by applying an agreed-upon percentage growth (usually uniform) to each item entry.

In short, conventional budgeting is purely fiscal, with the major effort recording the sources of funds and how they are spent. Although object classifications may vary among institutions, the thinking process and the data collected and presented in conventional accounting procedures is inadequate for use in the newer management techniques long used in industry and only more recently applied to similar problems in higher education. Program budgeting, on the other hand, is concerned with:

1. The alternative ways an institution can achieve its established goals and objectives.

2. The major programs of the university and their component parts rather than object classifications dictated by organizational structure cr function.

3. The resources required which are explicitly related to the given programs and program elements. These include faculty, support staff, space, equipment, and library.

4. "True" costs of major programs and program elements in terms of the resources these specific programs demand which ultimately can be converted into dollars.

5. The marginal or incremental cost as well as the opportunity cost which is associated with a given program or with reaching a given goal.

6. Long time periods.

7. Levels of activity, which for institutions of higher education can be numbers of degrees granted, research completed, services rendered.

Developing a Program Budget

There are three phases in the development of a program budget, namely, planning, programming, and budgeting. During the planning phase, the long-run purposes and objectives of the university are thoroughly questioned and examined. Typical questions include the following:

1. What is the university's responsibility for offering education within the various disciplines?

2. Should allied health sciences, basically two-year technical training programs, be the responsibility of an institution of higher education long known for its excellence at the B.A., M.A., and Ph.D. levels?

3. Does an evening division activity fit into the ongoing program of the university?

4. Are interdisciplinary programs of general advantage to the university, and if so, in what disciplines may they be worked out?

5. Should the university alter its enrollment mix, i.e., in-state versus out-of-state students, graduate versus undergraduate levels, males versus females?

6. Should the various departments be involved with both basic and applied research?

7. What should be the ratio of total effort within the departments in respect to undergraduate teaching, graduate teaching, basic research, applied research, and public service?

8. What organizational structure should be followed by the institution to most effectively carry out its main objective?

Obviously, these kinds of questions get at the very heart of the objectives and goals of the institution, give some order of priority to the programs which may contribute toward those goals and objectives, and provide a base upon which given resources of the university need to be allocated to achieve those goals and carry out the programs adopted.

The second phase of program budgeting is the programming activity which encompasses a shorter span of time, probably five to eight years. In this phase, the various programs are detailed and are especially relative to the resources which those programs command. In working out these details, it is customary to break down the major programs into program elements. For example, major programs on a college campus might well be training of engineering students, allied health science programs, liberal arts training, or summer school and evening division programs. Program elements would be logical parts of the general program, very typically academic departments within a given major division of the university. Each program element is carefully analyzed as to its resource needs and the contribution these resources make toward the goals of the program. Resource needs of the program elements can be added to arrive at total resource demands of the various major programs of the university. Throughout the programming phase, the value of contributions made by given resources as currently used must be constantly assessed relative to contributions possible through alternative uses.

The budgeting phase deals with the expression of the resource allocations to the various program elements and the major programs of the institution into dollar terms on an annual or a biennial budget basis. Obviously, the budgeting process occurs after the planning and programming have been thoroughly analyzed. Budgeting therefore reflects rather than dictates the major programs and activities of the institution.

Applying the Concept

In applying the principle of program budgeting, it is not essential to start with a long-run master plan for the institution. Rather it is preferable to begin with the so-called programming activity. Delineating the major programs of the institution and their supporting program elements and generating the kind of data about them which program budgeting dictates will focus on the absolute necessity of institutional planning and give some dimensions of the detail of the planning necessary. The programming activity must precede the budgeting function, however, as budgeting is merely the conversion of resources allocated into dollar terms.

The central administrative staff must endorse and actively support the study of the application of program budgeting to one or more parts of the institution. In this respect the central staff must recognize program budgeting as providing management information useful for sound decision-making, intuitively be willing to adopt the concepts of program budgeting when and if found useful, and explicitly be ready to allocate staff time for general application and development. Moreover the chief academic officer must help prepare the way for the study by explaining the purpose of program budgeting to his deans and department chairmen. Ideally the faculty should also understand the system. If so, they will cooperate in providing accurate information upon request, but more importantly, they will have an insight into the kinds of data available to the administration and how it may well be used in decision making. The faculty will generally be receptive because they have long believed the resources of the institution have been inappropriately allocated and program budgeting may result in redressing the balance.

It is my belief that the office of institutional research should carry out such a study. This office ideally should have the reputation of a research office equally available to the faculty and the central administrative staff. Physical location of the office, the existence of a functioning advisory board representing faculty and administration, and the appointment of a director with faculty status are essential criteria in creating this reputation. It is also essential for the institutional research director to be thoroughly familiar with the institution and its personnel and be well-recognized and respected by both faculty and administration.

Limiting the application of program budgeting initially to a segment of the institution is recommended. This approach will provide the institutional research staff with the necessary time to develop procedures and think them through for application to other perhaps more complicated segments of the institution. In this study the application was limited to one of the undergraduate colleges primarily because (1) the College is relatively small with a limited number of departments, (2) there is enough diversity within the college to provide a broad test for the major concepts of program budgeting, and (3) the Dean of the College has been generating data similar to that developed in program budgeting, and he is therefore sympathetic to the extension and refinement of the work already started.

This College contains a total of six departments. In the study, the College was considered a "major program" and each department a "program element." The study was done during July and August of 1967. A program budget was developed for the fiscal year completed June 30, 1967, and compared to the data generated by our conventional accounting procedures. This budget data was also used to project resource needs over the next few years and to evaluate the contribution of the resources toward the goals of the institution.

The basic information collected for each "program element" was divided into two general categories, "inputs" and "outputs." The inputs included the following:

1. The number of students who were aspirants for degrees at the Bachelor, Master, and Doctoral levels. (Data on undergraduates was supplied by class, by program from the Registrar's Office. The Graduate Dean provided a roster of graduate students which included the program, degree sought, expected date of graduation, and the existence of a fellowship.)

2. Personnel--faculty, graduate students who have specific teaching or research responsibilities, and support personnel in the categories of technicians and clerical workers.

3. Physical facilities--the amount and type of space specifically assigned. (The Institutional Research Office has a complete inventory of space by major use categories and its assignment to individual departments.)

4. Allocation of resources for supplies, equipment, and library.

The outputs included:

1. Educational--number of courses taught, student credit hours generated, and a breakdown of degrees granted. (The data were supplied by the Registrar's Office.)

2. Research activity--the number of research projects or grants both public and private, and the dollars involved. (The office of Research Administration, the Budget Officer, and consultations by the Dean with the various Department Chairmen provided this information.)

3. Service activity--the service activities at the level of the program element, the major program, the University, and the general public. (This information came from faculty members, Department Chairmen, the Dean, and central administrative officers.)

A Program Budget Summary Sheet for a program element is shown in Table 1. Several entries demand some explanation.

Degree aspirants are the number of matriculated students pursuing the respective degrees in this department.

Faculty resources were subdivided to reflect the different kinds of contributions faculty members make toward the ongoing programs of the college and the University. Entries have been expressed in percentages with one full-time faculty member being 100.

FTE stands for Full Time Equivalent and reflects the number of faculty members who have full-time employment with the University. Where faculty are employed on a part-time basis, these fractional times were added and converted to full-time equivalents.

FTTE is the abbreviation for Full Time Teaching Equivalent. One FTTE is defined as twelve credit hours of teaching, the belief being that a faculty member teaching twelve hours has little if any time available for other contributions to the program. Adjustments were made for laboratories, discussion sessions, seminars, independent study, and the like. A faculty member teaching six credit hours is therefore considered to be a half-time teacher.

FTSRE stands for Full Time Sponsored Research Equivalent. The FTSRE figures show the number of equivalent full-time faculty members engaged in sponsored research projects. (Budget figures which show the percentage of a total salary coming from "restricted" funds were used to determine the number of FTSRE.)

FTURE stands for Full Time University-sponsored Research Equivalents. This was determined by adding for all faculty the proportions of total time devoted to research projects where the University had adjusted other responsibilities that the research might take place. Time allocations were determined in consultation with the Department Chairmen and the Dean.

FTOE is the abbreviation for Full Time Other Equivalents and reflects the many activities outside of classroom teaching and research which command faculty time. The FTOE is determined by

FTOE = FTE - FTTE - FTSRE - FTURE.

Table 1

PROGRAM BUDGET SUMMARY SHEET

INPUTS	66-67	67-68	68-69	71-72	76-77
DEGREE ASPIRANTS					
Bachelors	122				
Master	5				
Doctor	0				
PERSONNEL					
Faculty					
FTE	6.00				
FTTE	3.07				
FTSRE	1.75				
FTURE	.26				
FTOE	.92				
Grad. Students	4.00				
SUPPORT: Tech.	3.00				
Cler.	0				
FACILITIES					
Physical					
No. Offices	8				
Sq. Ft. INSTRUCT.	4,059				
Sq. Ft. RESEARCH	3,160				
Sq. Ft. ADMIN.	1,051				
Sq. Ft. OTHER	1,852				
TOTAL SQ. FT.	10,122				
Expenditures					
Supl, Trav, Equip	52,953.15				
Library Support	2,100.00				
OUTPUTS					
EDUCATIONAL					
Courses Taught	17				
Total St.Cr.Hrs.Gen.	780				
SCH FTTE	177				
Degrees Granted:					
Bachelor	11				
Master	5				
Doctor	-				
RESEARCH ACTIVITY					
Projects/Grants					
No.					
Exp.					
SERVICE					

The working out of the allocation of faculty time within the preceding classifications is the very heart of the effort necessary for effective program budgeting. It brings into focus the allocation of this major resource among the various activities and makes it possible to relate that allocation with output. Other entries on the Summary Sheet are self-explanatory. All the entries come from support sheets which show the detail of the input and output data.

The program elements used in this study were consistent with the conventional budget identification used at the institution. As a result the resources allocated to a given program were easily converted into cost figures. Therefore the dollar cost of providing a given output was readily available, and the incremental cost of altering a given program can be easily determined. The identity of program elements with existing budget classifications facilitated comparisons between program budgeting and present practice. As experience is gained and program budgeting refined, the definition of a major program or program element should not be compromised by existing accounting procedures.

Projections

In this study each of the six departments in the College was a program element, and data equivalent in detail to that outlined above were collected for each. The aggregation of data from each comprise the input and output data for the College, a major program. On the College Summary Sheet additional columns were provided for projections. In planning ahead on a college campus, the major ingredient is the number of students at both the undergraduate and graduate levels. With the full implementation of the program budget these projections must reflect changes in teaching techniques, the mix of undergraduate and graduate students, changes in curriculum, and the proportion of contract research. With the full implementation of a program budget, these projections would be made by the I R Office in consultation with representatives of major programs to reflect changing goals and objectives.

Summary

Program budgeting need not be limited in application to the academic departments and major educational programs. Many related administrative or supportive activities lend themselves to the techniques. Cases in point are the library, the academic deans' offices, the computation center, the infirmary, the print shop, the testing service, admissions and registrar's office, continuing education, and the placement office. The central administrative offices and their supporting operations are more difficult to program budgeting because of the problem of allocating these joint costs to programs. It is recommended that these activities be considered as fixed costs of operation and treated in a manner consistent with the principles of direct costing.

Program budgeting:

1. Raises philosophical questions concerning the long-run objectives of the institution, the major programs, and program elements.

2. Brings into focus at all times the allocation of limited resources in the achievement of given goals.

3. Relates resources to specific ends and hence emphasizes alternative contributions from a given input.

4. Provides a sound basis for projecting resource needs as obligations expand and programs grow.

5. Provides a common denominator for comparison between programs.

6. Brings increased pressure for the development of centralized data collection and analysis.

7. Supports conventional fiduciary budgeting and allows for incremental adoption.

In addition program budgeting requires careful definition of the activities, functions, and objectives of the institution. In this respect it might well be wise to establish early some standard definitions which would facilitate inter-university comparisons. The key to the successful application of the technique is understanding and support by the central administrative staff, and its full effectiveness can only be realized when decision makers are in a position to use it as a management tool rather than a substitute for detailed legal and fiduciary accounting.

SYSTEMS ANALYSIS FOR INSTITUTIONAL OUTPUT DECISIONS

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During the fall of 1967, the Office of Institutional Research at the University of Michigan, began a long-term study of benefits attributable to the existence and operation of a university and of accompanying costs. The project has been undertaken because of increasing pressure upon institutions of higher education from state legislatures, private donors, and the federal government to give a more clear and concrete account of precisely what is accomplished with the higher education dollar (Taylor and Young, 1967). To date, progress on the study has consisted largely of walking around the problem, trying to grasp its parameters, and define its major elements.

Early probing quickly revealed that not only would cost-benefit analysis help explain university needs to the institution's several publics, but it might also be a valuable aid in making institutional output decisions. If all of the benefits accruing from university operations can be known and measured, as well as the concomitant costs, then university trustees and executive officers are in the enviable position of being able to allocate the institution's resources to achieve a precise combination of desired outputs. Therefore, what would really be helpful in making output decisions and in attracting additional support for higher education would be a complete description of the university as an institutional system, including all the ways in which the institution affects and is affected by its environment. Analysis of the system should include:

1. Identification of desired or intended university outputs (institutional objectives)--which may well be quite different as viewed by each group controlling direct inputs, i.e., state legislators, students, federal officials, and private donors.

2. Identification and measurement of direct and indirect inputs to the system. Inputs can be considered the costs of the system. Indirect inputs include such items as the contributions of the city road repair, sanitation, police and fire departments to the welfare of the university.

3. Analysis of the process of resource allocation and conflict resolution--that is, a description of the procedures and processes as well as of the value and power systems, through which conflicting objectives are reconciled.

4. Identification and measurement of actual outputs consistent with, but not necessarily articulated among, institutional objectives. (For purposes of this paper such benefits are classified as output effects.)

5. Identification and measurement of actual benefits from university operation, which are not part of the institution's output effects. These results are here called side effects. They include such effects as employment in the community due to university operations and availability of some university facilities to the local public at less than cost. Side effects are by definition benefits. Un-

desirable results of institutional activity are classified as indirect-cost inputs.

6. Analysis of the total impact of the institution, comprising a comparison of all institutional output effects and side effects produced to the sum of all direct and indirect costs exacted in the production process.

Logically, the six-part system analysis just outlined begins with identification and description of institutional objectives and intended outputs. Because this study is designed to treat the institution of higher education generically, and then apply useful analytic methods discovered to the University of Michigan (and because the authors have lacked the courage to tackle the task of seeking agreement on University of Michigan objectives), current literature in the field has been searched to determine widely held conclusions about the benefits accruing from higher education and from the existence of institutions of higher education. To date this search has uncovered several empirical studies, each dealing with one or two specific benefits. From the listing of benefits thus developed (abbreviated in Table 1) many of the commonly held goals of higher education can probably be imputed. Note that Table 1 categorizes institutional output effects into effects on students (both as recipients and contributors), research, and public service. These conventional labels have proved helpful in thinking about university output. Though the amount of documentation for each item varies, the literature supports both the pecuniary and nonpecuniary benefits listed.

The benefits classified as Side Effects in Table 1 comprise ways in which the existence of a university makes a desirable impact upon the community--quite aside from the primary products the institution produces. In many respects the side effects are similar to the impact of any large organization on a community or region; most fall in the economic realm--increased employment, income, etc. But the impact of a large resident faculty and staff upon a community is in some ways extraordinary. An institution of higher education is unusual in that much of its expenditure is for professional staff rather than for equipment and raw products. This is relevant to the community because people tend to spend their incomes locally, whereas equipment and raw product purchases are typically distributed much more broadly on a geographical basis.

Though this study, to date, has not dealt with the value system which lies behind the listing of benefits in Table 1, the reader is cautioned to keep in mind the intangible value inputs of students; federal, state, and local government officials; philanthropic foundations and individuals; and university staff members. Though our mass system of higher education has gained wide acceptance in our society (Campbell and Eckerman, 1964), and though most would agree that our social system is based on a philosophy of self-determinism through a process of political and economic choice, that does not mean that most would agree upon the same objectives for higher education. A thorough examination of the university as an input-output system must ultimately include examination of the way in which different value inputs are treated and reflected in institutional outputs.

Measurement of Output Effects and Side Effects

Having drawn up a tentative list of benefits for institutions of higher education, the next logical step was to face the need to measure both the output effects and side effects of institutional activity. Ideally, all benefits should

Table 1

BENEFITS FROM HIGHER EDUCATION ATTRIBUTABLE TO THE OUTPUT AND EXISTENCE OF THE INSTITUTION

		Pecuniary Benefits	Nonpecuniary Benefits
Institutional Output Effects	Students as Recipients	Higher incomes Increased job flexibility Increased mobility Opportunity for further education	Increased financial security More interesting job Increased receptivity to change Opportunity for further education Higher level of attitude toward one's environment Greater ability to think critically Better understanding of oneself
	Students as Contributors	Higher income tax payments Higher sales tax payments Higher property tax payments More volunteer work Lower welfare expenditures	Greater social awareness and concern Greater involvement in political activity More civic activities More children going to college
	Research and Public Service	Increased material welfare--production, employment, income and consumption.	Increase in knowledge Increased health services Better recreational services Better social relationships
Institutional Side Effects	Other	Institutional payroll Higher employment in region Higher employment in region due to primary industry and other organizations, not dependent on local markets, which were attracted to the region by (or established as a spin-off of) the institution Services furnished through institution's intern and trainee programs Increased accessibility of higher education programs	Higher level of government services Public availability of institution's programs More effective local government Higher level of nongovernment civic activity Increased accessibility of formal higher education programs

be measured in terms of dollars as a common denominator. In general, those effects classified as pecuniary benefits yield rather direct monetary returns somewhere in society. Institutional results such as higher incomes, job flexibility, and increased employment can be considered essentially materialistic effects of higher education which lend themselves to monetary quantification. Quite different techniques must be employed to measure a change in those items classified as non-pecuniary benefits.

After reviewing the most commonly used measures of output from the instructional process, they were discarded as grossly inadequate for any really meaningful analysis. The credit hour, for example, is neither a measure of input nor of output. It is only tenuously related to the effort expended by the student or the teacher, much less to what the student achieves toward his own education. Number of degrees granted represents another straw which is probably grasped by most, at one time or another, in a desperate attempt to show concrete evidence of the institution's productivity. However, no one would suggest that those students who do not receive a degree do not receive some worthwhile instruction, nor that degrees in various fields and at various levels, awarded to persons of differing intellectual capacity, represent equivalent units of output. What must be found are usefully sophisticated, and, at the same time, usefully simple measures of the value added by the education process. Only by measuring before-and-after differences in students can the institution's productivity with respect to the students be determined. For that matter, the same holds for all output effects and side effects of institutional operations. For this reason, the basic concept of value-added, as employed by economists, seems to be fundamental to valid techniques for measuring institutional output. It is probably more readily applicable to measurement of the pecuniary benefits of higher education, but many studies attempting to quantify less tangible results also utilize the same rationale in that they center on differences in attitude or on differences in problem-solving ability which can be attributed to the college experience. The remainder of this paper discusses more fully the benefits listed in Table 1, and, using actual data for the University of Michigan, estimates very roughly the pecuniary returns to the state and federal governments from their respective payments toward University of Michigan operations.

Pecuniary Benefits of Higher Education

The estimates made are based on relatively conservative assumptions.

1. Differences in lifetime income between college and noncollege graduates are not entirely attributable to college education. Family position and natural ability are also important. Yet, with an increasing number of occupations requiring undergraduate and graduate degrees, college clearly makes a difference. Following Denison's criteria (Denison, 1962), 60 percent of the income differential is attributed to the education process.

2. All college graduates remain in their home state or, equivalently, there is no net in-migration or out-migration of college graduates.

3. State and federal governments earn a return of 5 percent on investments which are alternatives to grants to higher education.

4. Though those with higher incomes pay higher taxes, in general they receive no more than others in benefits from government activity. In other words, their higher tax payments are not in return for proportionate services rendered by the government.

5. Everyone in the labor force will retire at sixty-five and expire at seventy-five.

Though the methods used in estimating pecuniary benefits are in many ways elementary, they nevertheless require some detailed explanation. Most obvious among monetary output effects are those accruing from the greater economic productivity of graduates. Beginning with all students who received degrees from the University of Michigan in 1965-1966, assume that all institutional costs produced those degrees. This is clearly a conceptual abstraction, but it is a satisfactory maximum estimate of direct costs. That expenditures were made over a period of approximately four years is balanced in that expenditures in any one year do not go solely to those who will be receiving degrees--but rather further the education of all those enrolled. What figures we have indicate that approximately 50 percent of Michigan undergraduates go on for graduate training in some institution and that approximately 25 percent of the M.A. recipients continue on to work toward the Ph.D. This reduces the number of output units at each level compared to data on degrees granted. In addition, many female graduates never enter the labor force, or do so only briefly. However, those not entering are generally available for volunteer work (Morgan et al., 1966).

As shown in Table 2, one contribution of college graduates is in the form of higher state and federal income tax payments. Assuming that state and federal governments could earn a return of approximately 5 percent on alternative investments, all future tax receipts must be discounted at that rate. The total stream of tax receipts must be reduced by what is called a present worth factor. Statistical tables are available to determine present worth once the rate of return and number of years the series is to extend are specified.

The 5 percent figure is undoubtedly an overstatement when only looking at the economic returns, but generosity in that direction means conservatism with respect to the contribution of higher education. Note also, that the contribution must be figured on a marginal basis--that is, the amount the government receives over and above what it would receive if the students terminated their education at graduation from high school. Median incomes, by education level, are available from national surveys (Katona et al., 1967; Marsh and Stafford, 1967).

The discounted differential state income tax payments made by college graduates is then the product of the Michigan income tax rate (2.6%), the present worth factor based on years to retirement, the median income differential, and the number of employed graduates. The procedure is identical for the federal income tax calculation using the marginal rates appropriate to the level of taxable income. One relatively minor adjustment can be made to account for the fact that more female college graduates work than do their high school counterparts (Morgan et al., 1966).

The differential incomes received by college graduates will also be subject to the State of Michigan sales tax to the extent that the individuals buy taxable items. Here it is assumed that 25 percent of the additional income is spent on taxable items and that this condition is maintained as long as the individual is part of the labor force. The discounted differential state sales tax revenue is

Table 2

CALCULATION OF PECUNIARY BENEFITS ATTRIBUTABLE TO THE OUTPUT AND EXISTENCE OF THE UNIVERSITY OF MICHIGAN, 1965-66

RATE OF RETURN TO THE STATE & LOCAL GOVERNMENTS
($ x 1000)

Income Tax Effect	11,435	
Sales Tax Effect	4,400	
Property Tax Effect	14,238	
	30,073	
Reduce by 40%	-12,029	
Net Tax Effect	18,044	
Volunteer Work	1,822	
Research	3,318	
Public Services	995	
Output Effect	24,179	24,179
State Income and Corporation Tax	15,653	
State Sales Tax	4,397	
Side Effect	20,050	20,050
Total Impact		44,229
State Appropriation		55,555
Tax Recovery as % of Expenditure		79.6%

RATE OF RETURN TO THE FEDERAL GOVERNMENT
($ x 1000)

Income Tax Effect	86,779	
Reduce by 40%	-34,712	
Net Tax Effect	52,067	
Research	40,973	
Output Effect	93,040	93,040
Institutional Side Effects	94,272	94,272
Total Impact		187,312
Federal Contracts and Grants		52,214
Tax Recovery as % of Expenditure		358.7%

then the product of the Michigan sales tax rate (4%), the present worth factor based on years to retirement, the median income differential, and the number of employed graduates. The adjustment for females discussed in the preceding paragraph applies here as well. When calculating the return to government units (see Table 2), the tax effects must be reduced by 40 percent to account for the fact that higher incomes and higher tax payments are not solely attributable to higher education.

In figuring property tax payments, it is unfortunate that the latest data on house value by educational levels are based on white, nonretired, nonfarm home owners in 1959 (Morgan, 1965). These figures indicate that college graduates have a mean house value that is 1.43 times the house value of high school graduates. This study assumes that the relationship is stable, but that house values on the whole have increased by 50 percent since 1959. It also assumes that all college graduates own their own homes or pay rent commensurate with the property value of the residence which they are renting.

Using 1966 property tax rates in Ann Arbor and mean differential house values, the property tax effect is simply the product of the two figures above, the present worth factor based on years to death and the number of employed college graduates. The computation assumes that female college graduates who work are either single and own their own homes or married and add an equal increment to the value of their family home.

Wives who are not working are available to do volunteer work in the community. Since such services would otherwise have to be purchased or tasks left undone, this is a contribution made by higher education as long as female college graduates do more volunteer work than do their high school counterparts. Figures show this to be so (Morgan et al., 1966). This effect includes a present worth factor based on life expectancy and assume the volunteer work is valued at $3.00 an hour.

It is clear that families of college graduates are less likely to need certain welfare services than those with less formal education. More studies are needed to determine the extent to which education affects the use of the social agencies, for this is as much a contribution of higher education as the direct tax payments of college graduates.

The pecuniary benefits from university research are even more difficult to measure than those accruing from the education of students. Some research output, for example, the miracle drugs which have saved many lives, simply cannot be valued in dollars. The relative stability of the United States economy due to increased knowledge of monetary and fiscal controls, and the better adjustment of man to his environment are examples of knowledge which may benefit society far more than the return on society's alternative investments, yet an actual rate is not readily available because of the nature of the returns. But basic research does have an inherent value. Although it is a high-risk investment, the potential overall returns are large enough for the federal government to subsidize such work to the tune of billions of dollars.

The question of whether the state should tax its citizens to increase the level of research in institutions of higher education hinges on the comparative returns on investments. One economist concludes that the contribution of education and advances in knowledge are responsible for 42 percent and 36 percent, respectively, of the increase in Real National Income per person employed between

1929 and 1957 (Denison, 1962). Although the high contributions of education may not continue to increase at the same rate (the deceleration being largely due to more and more schooling as well as improved teaching), the advances in knowledge contribution has no such ceiling effect, for it includes everything from better final products to more efficient distribution and service systems.

Though Denison has been criticized for classifying the entire residual component of the growth in Real National Income as advances in knowledge, he has not necessarily overstated the case. Research in institutions of higher education is in large part responsible, directly or indirectly, for the contribution of advances in knowledge. As a conservative estimate, this study counts expenditures on research as returning only their cost.

Research funded by the state or federal government is counted as a return to the government unit ($1,084,782 and $40,972,541, respectively, at the University of Michigan during 1965-66). Research funded by foundations and health agencies is assumed to be spent on areas otherwise under the authority of the state or local government and as such is counted as a benefit to the appropriate unit (an additional $2,233,231), whereas research funded by industry, related societies and associations, endowments and gifts, and other university funds (a total of $7,789,826) is not counted as a return to any governmental unit.

Institutions of higher education make a further contribution to society through various types of public service, yet such contributions are not counted in our GNP statistics. Undergraduate students often act as tutors to the disadvantaged; faculty members devote a percentage of their time to public service activities; and administrators involve themselves in community committees, community education programs, and other civic activities. It is possible to estimate the extent of faculty participation in this area at the University of Michigan through faculty effort reports. The value of this service, assumed to be a benefit to the state and local governments because it deals more with local problems, was about one million dollars in 1965-66 based on mean salaries by professorial level.

The existence of the University of Michigan in Ann Arbor brings certain benefits to the community, previously referred to as side effects. Separate studies are being conducted on the regional effects of institutions of higher education; this study examines only a global measure of these peripheral benefits.

Expenditures made by the institution eventually increase someone's bank account. Academic and nonacademic staff, suppliers of equipment and services, and contractors spend their incomes in the community. The recipients, in turn, buy more goods and services, which increase another's income. This is known in economics as the "multiplier" effect. Macro-economic models of the United States economy indicate that the return to the federal government, from expenditures on salaries of additional government employees, is almost completely recovered through the following sources when all multipliers are taken into account: corporate profits tax (9%), personal income tax (30.6%), excise tax (4.6%), employee contributions to social security (2%), employer contributions to social security (7.4%), and reduction in unemployment compensation (31.8%).

Since the University of Michigan spent $175,879,809 in 1965-66, the return to the federal government may be very roughly estimated at $94,272,000 or 53.6 percent of the expenditure (the reduction in unemployment compensation was not included to remain conservative in the estimates). Because Michigan levies a personal income tax (2.6%) and a corporate profits tax (5.6%), it is also the recipient of extra tax payments--about $15,653,000.

There is also a multiplier effect through the state sales tax. If one-fourth of the increased income in the community is used for items subject to the state sales tax of 4%, the State's revenue is increased by another $4,397,000.

In summarizing the assessment of pecuniary benefits, it should be emphasized that all assumptions made have been relatively conservative in terms of the contribution of higher education. For example, University of Michigan graduates may earn more than the national average income, income in general is rising at such a rate that the figures used here are certain to understate future conditions, and tax rates are also likely to rise. Furthermore, the higher tax revenues from college graduates are not in return for services rendered by the state or federal governments. On the contrary, college graduates probably receive less in the way of benefits per family than do noncollege graduates. In 1965-66, the general expenditures of the government of Michigan were $1.242 billion. An examination of these major expenditures justifies the notion that tax payments from college graduates are not just being exchanged for services rendered. Though children of college graduates are likely to go further in the education system, even here the private returns are not proportionate to the tax payments as college graduates tend to have fewer children per family.

Nonpecuniary Benefits of Higher Education

The nonpecuniary benefits are represented by the items so specified in Table 1. Though it may someday be possible to attach dollar figures to most of the benefits cited, others will remain unsusceptible to quantification. This paper has emphasized the need to include such unmeasurable variables in any decision-making process. Although space does not permit a thorough discussion of all of the nonpecuniary benefits, there are certain general areas which warrant comment. There is documentation that a strong relationship exists between the level of education of the head of the family and social awareness, mobility, and political participation.

Social awareness indices constructed from extensive survey data (Morgan et al., 1966) indicate that college graduates are more receptive to change and tend to avoid unnecessary risks. Morgan's receptivity index is composed of factors which affect our economic and technological development; the ready acceptance of new products and new ways of doing things represents an important characteristic of individuals who live in a rapidly changing and increasingly complex world. Morgan's index of caution and risk avoidance includes such disparate items as the use of auto seat belts, deliberate family planning, and saving habits.

There is evidence that mobility is also an issue when considering the institutional impact on the society. The United States is a free enterprise economy, and, as such, depends on its citizens to be informed about and willing to consider occupational vacancies which arise in other job classifications, other industries, and other locales. Though an entire text could be written about the psychological, sociological, and economics factors involved in moving to a new job, this paper is concerned with only those factors affected by educational level.

An examination of data on the mobility of families by age and education (Lansing and Mueller, 1967) shows that those with a college education do move more often and also more frequently cite economic motivations as the reason for a move. Though the actual move may be more expensive for those with college degrees (they are more likely to own their own homes and, therefore, must absorb the costs of a realtor and the moving or selling of furnishings), the college educated tend to have the higher incomes and the greater capital assets which are often in relatively liquid form (Katona et al., 1967) and therefore can more easily afford the move when opportunities arise.

Economics is not the only motive, nor costs of the move the only inhibiting factor. Perhaps of equal importance is the sense of security that comes from holding a particular job for most of a lifetime. This psychological factor is also differentially related to the level of educational attainment. As might be expected, those with more education place work and achievement above security among criteria for job preferences. Those with less education consistently feel security is more important and, as a result, they are less likely to have geographic mobility (Katona et al., 1967).

The other major factor in mobility is that of keeping abreast of the needs of industry. With rapid technological advances, old skills become obsolete and a period of special training or further education is necessary before one can take advantage of certain occupational vacancies. Again, the evidence is that the higher level of educational attainment, the more likely the continuance of training and education (Johnstone and Rivera, 1965; Morgan et al., 1966).

Those with a college education, therefore, are more likely to be mobile because: (1) they can best afford the cost of the move itself; (2) they receive their psychological security not from staying in one job, but by keeping up through furthering their education and thereby knowing they have current skills; and (3) work and achievement continue to influence their choice of jobs, which means they are more likely to notice information on occupational vacancies.

Given an economic system which requires a knowledgeable, informed citizenry, it is no accident that the same requirements hold for our political system. Those who do not vote or who vote only out of ignorance are not helping the elected representatives decide what is best for their constituents. There is little disagreement about the important role education plays in issue familiarity (Campbell et al., 1960), but what should be emphasized is that the educational system also has a major role in the individual's ability to conceptualize a point of view--a quality necessary to understand the complexities of current political problems (Campbell et al., 1960). Without the basic vocabulary of politics and the ability to think abstractly, political issues lead to confusion, and that in turn, generally leads to apathy on the part of the potential voters.

It is not surprising, therefore, that the more highly educated are more involved in the entire political process. They attempt to influence others, vote more often, have a higher sense of political efficacy, and a fuller recognition of the concept of citizenry (Campbell et al., 1960).

Though the broad implications of increased political participation are clear, there are many areas which remain to be studied. These include the extent of education's role in voting for higher tax rates and school bonds. Both decisions are means of bringing about increased investment in education, and, if the present analysis is correct, of placing funds in an area which will return higher payoffs than other forms of expenditure open to state and federal governments. To the extent that education contributes to such voting decisions, it also contributes to society for it means that our country's resources are being used more efficiently.

Comparison of Alternative Investments

Higher education is in the unusual position of attracting financial support from many areas. Thus, the appropriation of any single governmental body is supplemented by other governmental units, private donors, and students. Furthermore, education increases the productivity of those participating in the process which is what leads to the increased governmental tax receipts previously discussed.

To answer the question of whether government bodies should spend more on higher education, the rate of return on alternative investments must be known. Though such an analysis goes much beyond the scope of this paper, it is not likely that any other investment can match education. The basic reason for this is that educational expenditures produce side effects similar to other types of investment expenditures. In addition, investment in education yields not only greater productive capacity through greater knowledge and skills, but it yields also an invaluable bonus to the personal lives of many--a bonus which is unfortunately not measurable in dollars.

On the basis of the figures summarized in Table 2, it is possible to calculate an estimate of the return to the various levels of government. The University of Michigan received an appropriation of $55,555,000 from the State for the 1965-66 academic year. Our analysis shows that the state and local governments will recover 79.6 percent of that expenditure through higher tax receipts, research benefits, volunteer work, and public service attributable to the University of Michigan. The corresponding federal investment in the University of Michigan in terms of contracts and grants was $52,214,000, and the corresponding rate of recovery is 358.7 percent.

On the assumption that a college education in a public institution of higher education which has a nominal tuition fee, costs the student $20,000 (made up mostly of foregone earnings--based on three-fourths of a high school graduate's initial income after taxes--but not including living expenses) and that additional graduate study costs $15,000 for an M. A. and $25,000 for a Ph.D. (Butter, 1966), a return can also be calculated for students. The additional cost of a Ph.D. may seem small but such individuals usually receive fellowships and remuneration for teaching and research. It should be emphasized that the rate of return to the students is very sensitive to the cost estimates. Costs vary considerably by sex and field, yet here only an overall return by educational level is specified:

Table 3

EDUCATIONAL COSTS AND RATE OF RETURN BY DEGREE LEVEL

Educational Level	Differential Lifetime Earnings Stream Discounted for Time, Natural Ability, and Taxes	Cost of Degree	Rate of Return
B.A.	$22,786	$20,000	13.9%
M.A.	43,344	35,000	23.8%
Ph.D.	56,923	45,000	26.5%

On the basis of the tax recovery and rate of return figures alone, it is not possible to argue that any one group should be contributing more to the financing of higher education. The nonpecuniary benefits must also be taken into account. If the benefits to society far exceed those to the individual, the state and federal governments should share more of the financial burden. If the nation benefits more than the state, the federal government should direct more of its tax revenues to institutions of higher education.

This paper has attempted to provide both a methodology which can be applied by any institution of higher education to determine its pecuniary impact on various governmental levels and a rationale for increased support of higher education due to the additional nonpecuniary benefits. Further research is necessary in many areas--particularly in the refinement of measurements of indirect costs attributable to the existence and operation of the institution and in further quantification of the value added to students' lives and to society by the educational process.

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SYNTHETIC OUTPUT BY SIMULATION

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If we were to revert from "buzz" words to plain English synonyms, the title of this panel session might read, "Artificial Information by Pretending." Such a literal translation of the jargon could well be made by the uninitiated using a contemporary dictionary. Of course, that happy translation does not do full justice to the rich and subtle meanings that "Synthetic Output by Simulation" evokes in those who are aware of the powerful impact modern systems science is having on research of all kinds these days. On the other hand, the simpler interpretation may not be too far off the mark.

Simulation is a technique that is being applied to all kinds of research, from anthropology to zoology, from bureaucracy to urban land use, from aerospace systems to warehouse location. It is a particularly powerful tool in the hands of the engineers designing machines. Planners, management scientists, and economists have positively fallen in love with simulation in their search for ways to predict and control the development of complex organizational and social systems.

The purpose of this panel is to take note of some of the applications of simulation, modeling, and gaming to institutions of higher education. Our panelists were selected to represent a diverse range of experimentation and application of simulation models to colleges and universities. By way of introduction I shall make some general remarks about the nature, uses, and problems of simulation models in higher education administration and planning.

In its most general sense, simulation is the process of synthetically manipulating the variables in a model of some physical, biological, or social system for the purpose of understanding, experimenting with, and predicting the behavior of the system.

With a reasonably satisfactory model of the system, simulation may be used to evaluate or predict the costs or consequences of possible changes in the system over time. However, when knowledge of the system is too inadequate to develop an acceptable model, simulation may be used as a research method to test a variety of hypothesized models. A range of synthetic values for unknown parameters may be exercised and compared with known characteristics to see which model seems best to explain the nature of the system.

One of the more fascinating and fruitful forms of simulation applied to complex social systems is gaming. War games and management games have developed to a high degree of sophistication, especially with the advent of the computer. An imaginary but realistic environment is given the players, acting as part of the system, who make decisions in response to information and learn the consequences of their decisions in relation to the goals they are expected to optimize. Training in organization and operations decision making by simulation will become even more effective as shared-time, rapid response computer gaming is perfected in the next few years.

Gaming also is being increasingly used for controlled artificial experimentation with the behavior of players acting in competitive, stressful, or cooperative situations. The potential of this kind of simulation application for institutional research merits consideration, especially by those interested in organization behavior, the college culture, and decision theory.

Upon drawing the assignment last year to chair this panel, I set out with the intention of surveying the field to learn what people in institutional research are doing in the way of modeling and simulation. In no time at all it became apparent that literally hundreds of people in dozens of institutions and agencies are working on one kind or another simulation model of some aspect of higher education. The diversity of approaches and applications is so great that brief summarization of the state of the art would be impossible--and perhaps fruitless. Finally, it became painfully obvious that most efforts have yet to bear fruit in the way of actual output that can be significantly useful in the institution's policy-making and planning process.

There are many model designs in the advanced stage of development; most of these are nonoperational as yet because their users are unable to acquire the data needed to place meaningful values on the variables. (By "meaningful," I mean those values institutional officers can judge to be valid in relation to their real world experience.)

At present, the major benefit flowing out of these efforts to develop institutional simulation models is more orderly, organized thinking about the nature of colleges and universities. In most cases I have observed, the design of a model is immediately followed by the initiation of intensive efforts to construct comprehensive information systems. Since the development of information systems usually turns out to be a long, laborious task, the model may be put on the shelf until the desired data are developed.

The act of designing the model, however, usually has a major influence on determining the types and forms of information required. Furthermore, since many kinds of information demanded by the models are not being generated in institutional operations, model design tends to set the agenda for institutional research, clarifying the kinds of in-depth studies needed to fill information gaps.

As yet, however, very few simulation models are actually being used in the institutional decision-making process in planning and resource allocation. There are several reasons for this state of affairs:

First, the lack of adequate data to establish a reasonable set of values for the parameters describing the relationships in the system inhibits the activation of the model as an aid to administrative decision making. Responsible administrators are naturally loathe to trust the "synthetic output" of a simulation model if the data put into the model are unreliable.

Secondly, the communication gap between the technicians who develop the model and the administrators who are likely to use it may be a serious problem. Either the technicians really don't understand the kinds of relationships and output that are relevant to the administrator, or the administrator--the English professor turned dean--does not comprehend the jargon, methods, or numbers the technician uses in explaining his handiwork. It may take a full generation before higher level academic administrators are sufficiently sophisticated to make use of the potential of simulation and at the same time understand its limitations.

Finally, a president, treasurer, or dean can hardly be expected to make much use of a model that is so complex that he can't understand it or so simplified that it doesn't tell him anything. We must look for the middle ground called for by Richard Cyert (1966) "where the model is complicated enough to deal with reality but not so complicated that it impedes our comprehension of this reality."

At the University of Rochester, we have boiled down our planning model of the instructional program to such simple elements that it no longer deserves the title of "simulation model." I am guilty of referring to it as simulation, but essentially it is merely a computational procedure for evaluating gross alternative future possibilities. Nevertheless, the simple version has been of major value in assessing the impact of alternative enrollment sizes and mixes and alternative academic policies on the University of Rochester's ten-year financial requirements (Mason, 1967 and 1968).

In the meantime, we have turned our research effort to a much more specialized variety of modeling. Under a grant from the Esso Education Foundation, my associate, F. W. Arcuri, is using a sophisticated mathematical model of student-course interaction as a tool for comparing the academic program structures of different institutions. This work, which will be reported in the near future, shows great promise as a powerful research method for probing the effects of academic policies and practices on resource requirements.

Arcuri's work also has demonstrated to me--a mathematical illiterate and cookbook statistician--the great importance of higher level mathematical abstraction in using models for research. As a director of institutional research and planning, I have been immersed in the problems of feeding information, analysis, and projections into the real-world decision processes of the university in all its complexity. The promise of the computer's ability to handle this complexity was very appealing.

My tendency--and I suspect that many of us--was to try to conceptualize the university as a "total" system and to model it in the sense of isolating what seemed to be the most critical variables affecting the kinds of difficult decisions being faced. But I could not escape the desire to express these variables in terms of the concrete operating language of the institution. I could not resist trying to account for as many of the real-world constraints and idiosyncrasies as possible. In no time at all my intuitive conceptualization of the institutional system greatly exceeded manageability and comprehensibility. The conception was not a model of the system, but an attempt to grasp the entire institution in terms of students, faculty, staff, dollars, square feet, activities, class sizes, contact hours, automobiles, and so on through the whole vocabulary of real things with which we deal.

In Arcuri's project, although the data put into the model involve real students in real institutions requesting real courses, the real-world constraints operating on the scheduling-sectioning problem are reduced to abstracted representation. At this stage, the model deals with a logical inventory of time unit and room unit pairs. A principal objective of the model is to measure the effect of the complex interaction of demand activities in time on expected facilities utilization. The current output of the model is a set of measurements of the structure of an institution's academic program.

Starting with only two elements of real data--the identity of the individual student and the identity of the course section--the Arcuri model produces measures of student course loads, class size distributions, the degree of prescribed curriculum or lock-step course enrollment patterns, and a series of completely new measures reflecting the nature of the interaction of students and courses. The comparison of the quantitative characteristics of a number of institutions--ten widely varying types so far--provides the basis for inferences about the impact of variation of program structure on resource utilization.

Subsequently by adding categories describing the attributes of students and the attributes of courses, the Arcuri model can become the basis for simulating the process of students interacting with courses in relation to space and time resources.

The value of abstracting a complex problem to a much simplified mathematical model does not need to be demonstrated to those of you with better scientific and mathematical backgrounds than mine. I have related this adventure in some detail because I have observed that many institutions get entangled with massive complexity in attempting to develop planning models only to see their efforts break down, leading to considerable disenchantment.

This leads me to some final observations on the process of wheel reinvention, allegedly a common ailment of institutional research. In the first place, we are not dealing with anything as simple as the wheel, although I have noted a number of schematic diagrams of models represented by the hub, spokes, and rim analogy. Secondly, I have yet to see identical models arise from independent investigators. Although many have common characteristics reflecting the common denominators among institutions of higher education, every effort has a differing approach and emphasis. At this stage of development of the art, the more experimentation carried on in different kinds of institutions with different kinds of approaches, the greater progress will be. As individuals develop, test, and publish their efforts, the trading and borrowing of ideas and methods should begin to shape a comprehensive and diversified technology.

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PROGRAM-BASED DECISION MODELS AT THE UNIVERSITY OF TORONTO

Bertrand L. Hansen

In 1965 the Bladen Commission report on the financing of higher education in Canada was issued. Appended to the report was a discussion of the construction of a prototype model of the Faculty of Arts and Science at the University of Toronto. This study of the prototype was spearheaded by Professor Richard Judy, Department of Political Economy at the University of Toronto, and Mr. Jack Levine, a Ph.D. candidate in Operations Research.[1] The decision was made early in 1966 to extend the model to the entire University. Subsequently, the Office of Institutional Research was established in the organization of the Vice-President, Administration with the Director cross-appointed as Special Assistant to the President. I was hired for this position in July 1966. The office is now staffed with six full-time systems analyst/programmers in addition to the necessary support staff.

It might be useful to view our own activities in comparison to the usual activities of offices of institutional research. A recent publication of AIR shows the duties and responsibilities of persons in institutional research positions to be primarily the study of students--particularly psychological testing, socio-economic studies, research on student values and cultures. Our efforts are minimal in this area. Our concern is largely with planning and coordination, budgets and finances, data systems and computers as instruments for collecting, storing, and reporting various kinds of enrollment, space and financial information, and the integration of this information in various formats especially constructed for decision-making.

We do a great deal of model building in our institutional research. Figure 1 shows a generalized classification of models. The types of models are appropriately grouped at each model level and the directional arrows are included to indicate interim steps in the building of more concrete models from mental abstractions. It is with the grouping of symbolic models (mental, logical, mathematical, and verbal) that we are concerned at the University of Toronto. And, it is worth noting that in our initial work we have concentrated on building simulation models rather than mathematically optimized models. The latter types assume that an objective function can be defined precisely and that the systems of equations can be solved to provide a solution which fits the objective. In the early stages we know that we cannot do this. Perhaps after we have defined the system we will be able to do some model building which is based on manpower goals. We look forward to this with some relish after having struggled so long with procedural problems. In any case, our ultimate concern is for the integration of information on people, money, and space for better decision-making.

Figure 2 is a skeleton version of the simulation model of the University of Toronto. At this point it is convenient to take a subsystem approach to the discussion of the model and to bring in, as appropriate, the other activities that have absorbed our attention as a more or less direct result of our attempts to refine each subsystem.

Figure 1

A Classification of Models

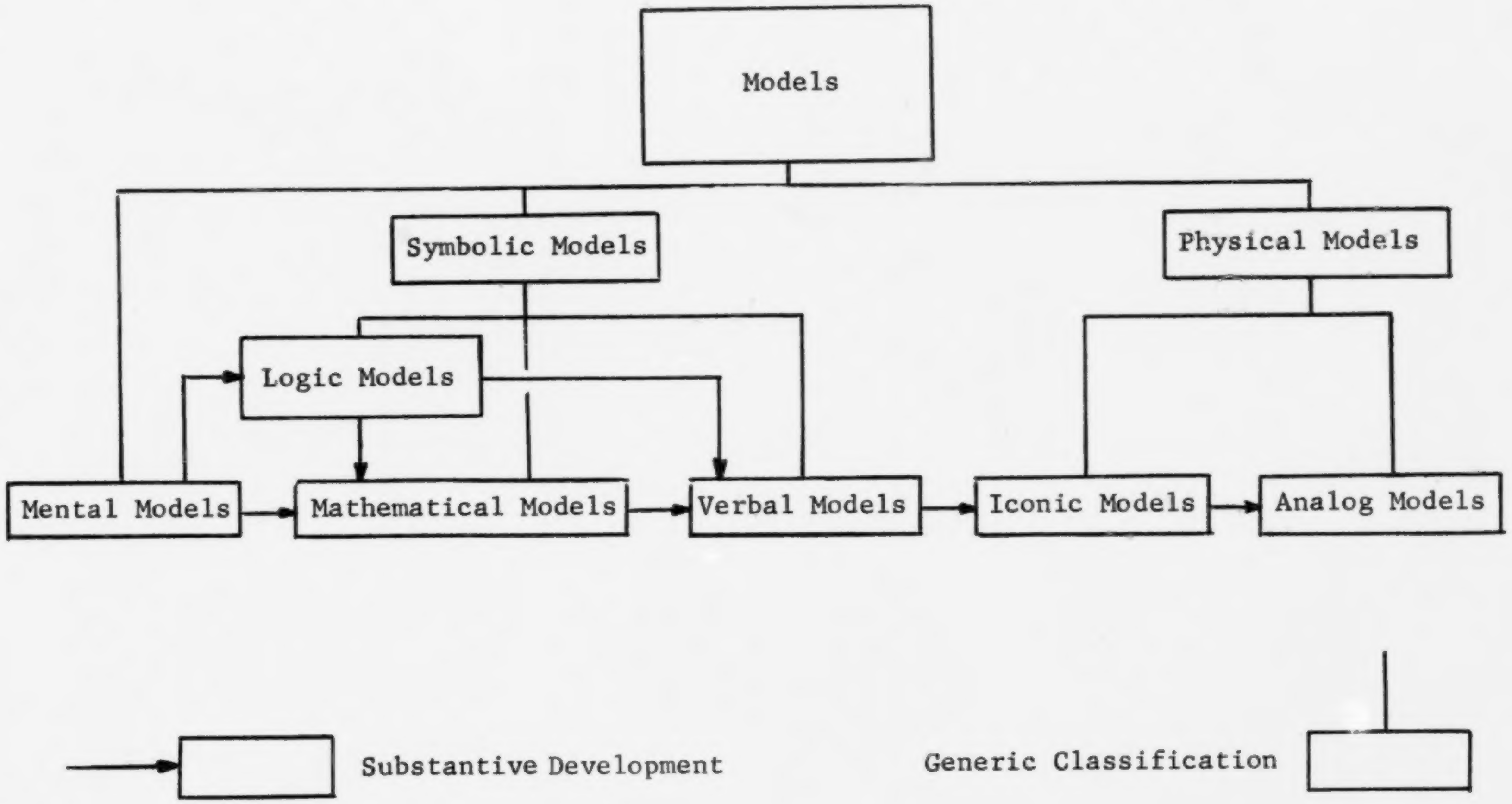
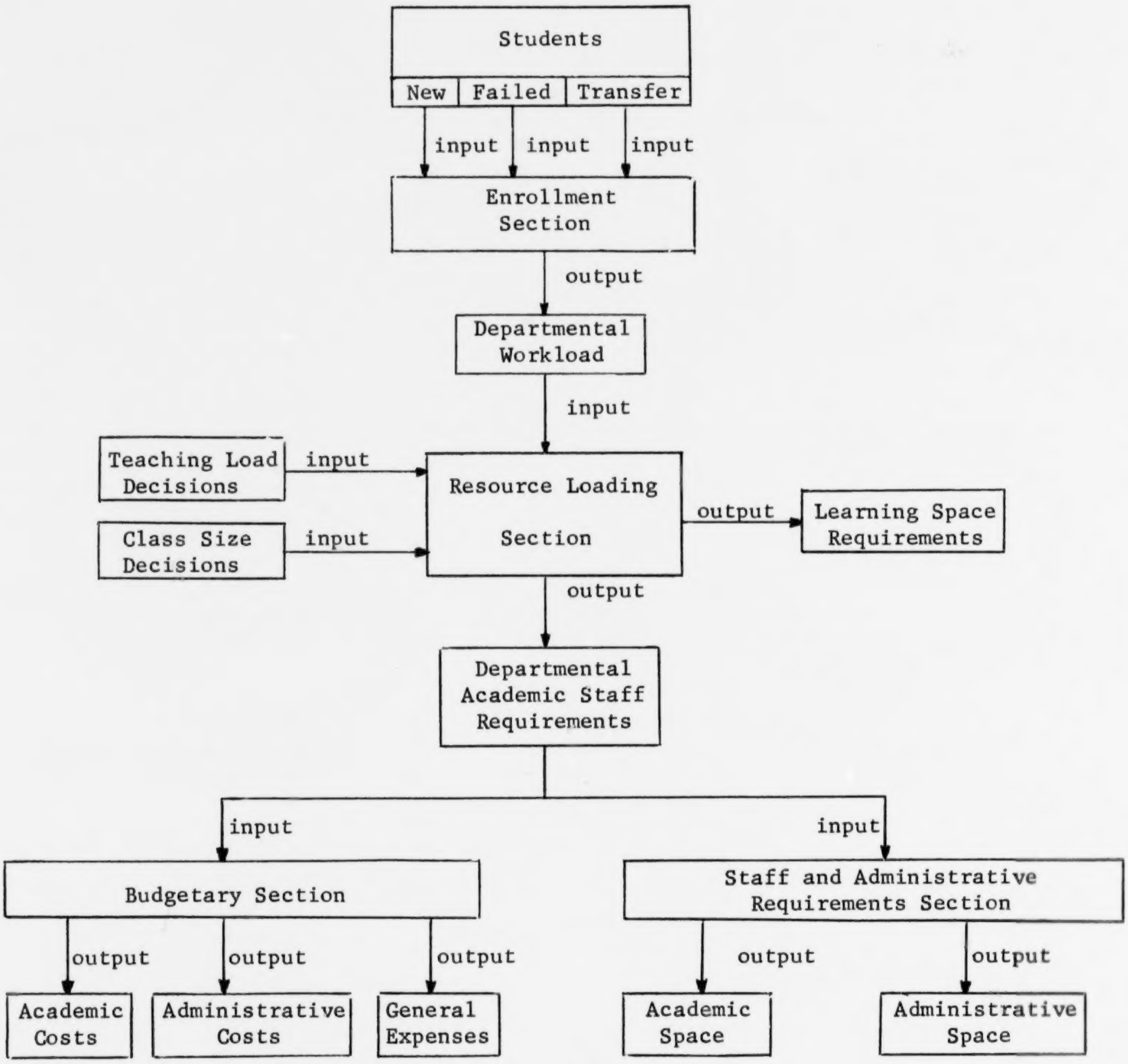


Figure 2

Skeleton of Campus



Enrollment Subsystem

This section takes enrollment in the University--for the present and as many calendar years into the future as desired--splits this enrollment into academic years by college and faculty, into courses of study (programs) and eventually into departmental workload in the form of students and student hours by subject and academic year. There are very important enrollment parameters for which we have to provide values--passing, failing, and switching rates, distribution into colleges, faculties, courses of study, and departments. The definition of a parameter is a variable which becomes a constant in a given situation. Thus, a 10 percent failing rate means that the parameter failing rate has taken on a value of 10 percent. The question comes up of how best to obtain these values. You can study the past data and you can do the ditch-digging work of asking the people who know the most about this information. We did some agonizing on this and I think fortunately hit upon a procedural information system which would provide us with the information we needed for the model and which would also be useful in formulating the annual departmental budgets by other than the usual incremental methods. Thus, program budgeting got its start at the University of Toronto, and we are intimately involved in this right now. In its initial phases the program budgeting procedure seeks to identify current and future workload by program (degree, diploma) by academic year expressed as numbers of students, students enrolled in subjects, student hours, and graduate supervision hours. Once identified, all workload required by all programs is then sorted to provide departments with a display of current and future workload that they are going to be required to support for their own programs and for all other programs in the University for which they provide service. Thus, for example, the analysis of the Bachelor of Science in Forestry may show an increasing student enrollment with attendant increase in the one history subject required. When this information is collected with enrollment in history in all other courses of study the history department chairman is presented with information on what gross workload (broken down by academic year) he will be required to support for the various history subjects over the next five years. The department chairman should be in a better informative position to justify his budget requests, and our office is certainly in a better position for providing values for the enrollment distribution parameters because the values are automatically provided by the system. Add to this the obvious benefits of program planning and budgeting at each decision level.

Resource Loading Subsystem

In this subsystem we are concerned with what types of academic and facilities resources are required--the mix of professional staff to meet the mix of instructional, graduate student supervision and research workloads required of the department, and the mix of classrooms required. Because of this we sought active involvement in a recent Canada-wide university cost study. The data derived from this study are useful for forming time distribution profiles of professors of different ranks in the various departments. We can use these historical profiles (adjusted as required) in the matching of teacher requirements.

Also, in this subsystem, there are two very important decision parameters that come into play--teaching load and class sizes. These are concerned with how the workload is handled. Suppose, for illustration, the gross first year history workload is 2000 student hours. Division by an average class size of 50 yields 40 class hours. Suppose also that a normal teaching load is 8 class hours--then

5 professors would be required to handle the workload in average class sizes of 50. Using this kind of analysis it doesn't take too much reflection to see what enormous economic implications there are in making class sizes smaller, not that this may not be the right decision. But, it is here that academic values have immediate impact on the resources of the university--the money to pay the staff, the space to house the staff, classrooms of the proper size and in sufficient number. A decision to break a lecture class of 100 that meets for one hour into 10 tutorial sections of 10 students each that meet for one hour has great effect in all of these respects. We are then directly concerned with cost/benefit analysis. Does the benefit justify the cost? Table 1 is from a recent study we made that shows a "before" and "after" comparison of the allocation of resources by the Department of Political Economy in the Faculty of Arts and Sciences at the University of Toronto. The present pattern shows how the resources actually were allocated in the 1967-68 academic year. The Macpherson pattern shows how the resources would have been allocated if the implications of a recent report on undergraduate instruction at the University of Toronto were applied in that year.[2] A few of the many important recommendations in this report were that lecture periods should be reduced to no more than one two-hour period per week; that there should be a marked shift to small tutorials of no more than 12 students per tutorial; and that first year tutorials should be taught mainly by full-time staff.

Note that the total full-time equivalent staff is approximately the same with either pattern except that there would be a somewhat greater requirement for demonstrators. The great changes are in the shift from lecture hours to tutorial hours within each major program in political economy and the consequent effects on uses of rooms of different size. An additional problem arises in the creation of some excess capacity in commerce with the simulated Macpherson pattern (9.7 FTE vs. 11.6 FTE). It is possible that the skills possessed by commerce professors are at least partially transferable to economics. If not, the increased cost would be in the order of about 2.3 FTE staff distributed to political science and economics and the increase of 161 demonstrator hours per week for the length of the session. And, since resources are limited, this requirement might have to be taken from the graduate department of political economy or if not that, from some other function of the University. There is also some increase in the cost of changing the space configuration to one of many small-size tutorial rooms and large-size lecture halls with a corresponding reduction in rooms of intermediate size.

Space Allocation Subsystem

To build this subsystem properly we had to undertake an inventory of all space at the University of Toronto. We are just completing that enormous task. The models constructed for this subsystem operate in this fashion. First, statistical summaries and reports on available space are printed out by examining the space inventory file. Forecasted space requirements are then calculated from the information provided by the Enrollment and Resource loading sections of CAMPUS. Next required space is matched against available space and various measures of utilization are computed. The resulting planning and decision information is printed. These steps are repeated for each session simulated with appropriate updating of information. The steps are also repeated for any changes to the decision parameters that we might wish to examine. Planning models have been developed for the different types of space in the University including classrooms, instructional and research laboratories, academic, research, and administrative offices, and residences.

Table 1

ANALYSIS OF MACPHERSON REPORT RECOMMENDATIONS ON UNDERGRADUATE INSTRUCTION

Department of Political Economy 1967-68

	POLITICAL SCIENCE		COMMERCE		ECONOMICS		TOTAL		
	PRESENT PATTERN	MAC PATTERN	PRESENT PATTERN	MAC PATTERN	PRESENT PATTERN	MAC PATTERN	PRESENT PATTERN	MAC PATTERN	DIFFERENCE
CONTACT HOURS									
Lecture	62.50	31.0	60.50	21.0	79.50	43.0	202.50	95.0	- 107.50
Tutorial	72.25	192.0	19.25	38.0	75.75	208.0	167.25	438.0	+ 270.75
TOTAL:	134.75	223.0	79.75	59.0	155.25	251.0	369.75	533.0	+ 163.25
FULL-TIME EQUIVALENTS									
Full	2.5	2.0	3.2	4.5	4.7	5.3	10.4	11.8	+ 1.4
Associate	4.9	4.5	3.4	2.0	4.8	5.0	13.1	11.5	- 1.6
Assistant	3.9	4.2	2.6	0.8	4.0	3.6	10.5	8.6	- 1.9
Lecturer	2.7	3.9	2.4	2.4	2.3	3.4	7.4	9.7	+ 2.3
TOTAL:	14.0	14.6	11.6	9.7	15.8	17.3	41.4	41.6	+ 0.2
DEMONSTRATOR HOURS	53	131	11	18	62	138	126	287	+ 161
ROOM HOURS/ WEEK									
0-20							193	452	+ 259
20-60							67	39	- 28
60-100							59	6	- 53
100-180							45	20	- 25
180 & over							6	16	+ 10
TOTAL:							370	533	+ 163

The Budgetary Subsystem

This section accepts output from the resource loading section in the form of numbers and kinds of academic staff required by departments and it costs the academic resources and associated library, administrative and other resources as some related function of these academic resources. The analysis of the Macpherson pattern of Table 1 could be carried further here to yield budget implications as well as space requirements from the previous section.

In order to be able to handle this budgetary section properly we created a file of the university budgets for the past several years which we use for showing the distribution of money to expenditure accounts and to organizational units, the percentage distribution of these expenditures to the various components of expense, and indexes of the expenditures related to the base year. We are able to arrange these analytical reports so that the expenditures may be viewed over a range of years at the four levels of interest and need--namely the university, academic, division, and department levels. It is very useful for tracing growth. This file will be updated annually and provides us with the historical basis for projecting costs into the future.

Staff and Administrative Space Requirements Section

This section also accepts academic staff output from the resource loading section and with space allocation models converts the data into office space requirements for both academic and administrative staff.

The Provincial System

Shortly after my arrival at the University of Toronto the Office of Institutional Research became involved in a problem of determining how a new provincial financing formula would affect Toronto's operating income in future years. In applying the formula, the enrollment of students is distributed to about sixty different programs of study. Each of the programs is weighted by an approximate cost per student in index form upward from the unit weight of 1 for a general arts or general science student to a top weight of 6 for the Ph.D. student. The products of students and weights are determined and are summed to yield "income units" for the university. The income unit value is adjusted annually for cost of living and whatever additional improvements the Province feels it can afford to allocate to university affairs. In the beginning it was important to determine how Toronto would fare with application of the formula, and further, if it appeared that it was being treated unfairly, what changes in the program weights would distribute the income in a more equitable pattern. We built a simulation program which enabled us to see the distribution of numbers and percentages of students, income units and operating income to the different universities in the Province. By varying the program weights we were able to simulate the income results of a change in the weighting system. In analysis of Basic Operating Income we found that Toronto has 12.7 percent of the income that is derived from general arts students in the Province. Looking at the distribution of income we found that 8.5 percent of Toronto's total basic operating income is derived from the General Arts program. In the case of graduate social work, Toronto has all students, income units and all income deriving from enrollment in graduate social work and that this enrollment accounts for 1.1 percent of Toronto's basic operating income. One simulation we did was to increase the graduate weights by a factor of 1.5.

The increase to Toronto's income with this change would be about 2.25 million dollars. (Toronto has about 40 percent of the graduate students in the provincial universities.) But of course, with funds limited to the same amount, this meant taking some money away from other universities. Fortunately, the allocation of income by the formula was more equitable with the original weighting system. Also, we are now in a better information position to test the validity of the weighting system. This testing is going on now.

We have become involved in many other provincial studies. Not long ago there was a consultant's report which recommended the formation of an Ontario University system similar to the California model.[3] While the presidents of the Ontario universities saw no need to, in effect, incorporate an organizational hierarchy superimposed on the separate universities, it could not be denied that the process of coordination and cooperation was greatly facilitated by the report. One of the exciting features of university development in the Province of Ontario is the emergence of a university system.[4] The presidents of the Ontario universities have an active committee structure and this committee, through its staff groups, is doing a great deal of good work in the areas of library systems, capital financing, computer systems, and student aid. We feel fortunate in our office at having an opportunity to participate actively in several of the research projects sponsored by the Committee of Presidents--including, in addition to the formula financing analysis, other studies such as analysis of the fee structures at the universities, analysis of secular growth in the various components of operating costs, salary analyses in comparison to other jurisdictions, development of models for financing emerging universities, and long-range planning of the development of the Ontario universities system.

Footnotes

1. See R. W. Judy and J. B. Levine, A New Tool for Educational Administrators, Toronto, 1965.

2. Presidential Advisory Committee on Undergraduate Instruction in the Faculty of Arts and Science, Undergraduate Instruction in Arts and Science, Toronto, 1967.

3. J. W. T. Spinks et al., Development of Graduate Programs in Ontario Universities, Toronto, 1966.

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MANAGEMENT USE OF SIMULATION IN LONG-RANGE PLANNING FOR COLLEGES AND UNIVERSITIES

Collin Scarborough
Peat, Marwick, Livingston & Co.

This paper describes a planning model designed to simulate the future consequences of alternative planning decisions for institutions of higher education. The model was designed as an operational prototype for seminar use by university and college administrators in a time-shared computer environment.

The Planning Problem

Institutions of higher education, both public and private, face problems of growth and change that are becoming more critical each year. The increasing number of students wanting to attend college and the changes in subject matter and educational technology demand that institutions continually reappraise their policies and plans.

Because of limited resources and competing demands for both private and public funds, it becomes increasingly important for university administrators to plan more effectively than in the past. The specific planning decisions in question deal with enrollment increases, curriculum changes, class sizes, faculty size and skill, utilization of physical facilities, construction of new facilities, number and length of semesters, tuition and faculty salaries, fund raising and utilization of investment funds, and sponsored research programs.

Although much has been done to analyze particular aspects of educational activities and individual resources, no concerted effort has been made to deal with programs and resources as an overall system. The large number of alternatives that are feasible, the complexity of interrelationships among programs and resources, the lack of adequately structured information, and normal manpower and time limitations have precluded a comprehensive analysis of the future consequences of alternative planning decisions.

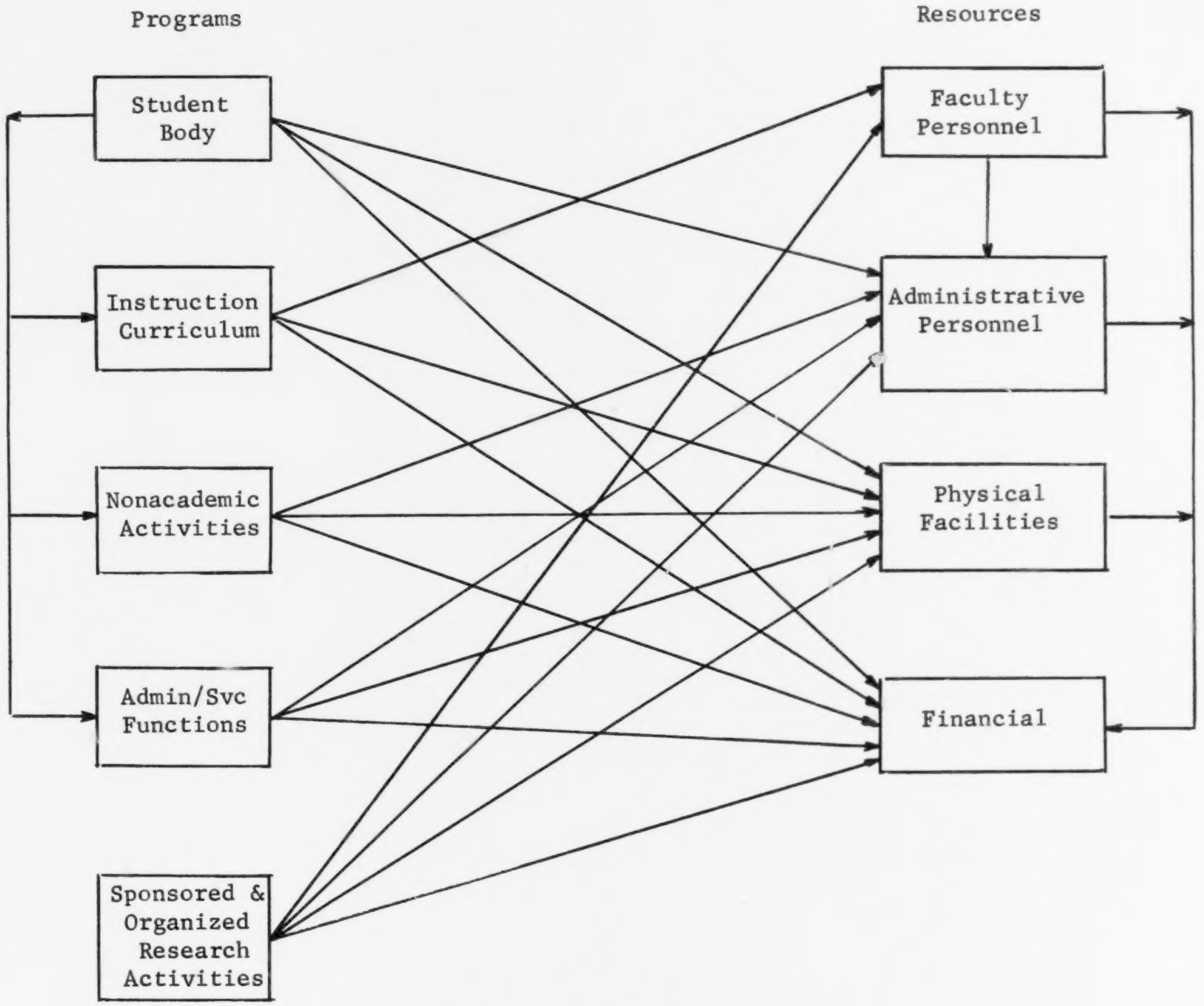
A New Approach

The essential features of our approach to the planning problems of educational institutions are (1) a structured methodology, such as planning, programming and budgeting, for relating objectives and plans within a systematic framework; (2) a data base for supporting this methodology; (3) a computer model designed to simulate the consequences of alternative planning decisions; and (4) implementation of the data base and planning model on a direct-access computer for rapid iterative use by university administrators themselves.

The primary purpose of a planning methodology is to achieve the most effective allocation of available resources over a period of time. Plans must therefore be designed around program elements and related resource impacts, rather than around object classifications. Examples of program and resource elements and their interactions are illustrated in Figure 1.

Figure 1

Relationships Between Programs & Resources



The basic steps in a planning methodology are to: (1) establish measurable goals and priorities, (2) evaluate alternatives for attaining the goals within assigned priorities, (3) project resource demands of selected programs over the planning period, and (4) measure performance against projections.

The principles of planning, programming, and budgeting cannot, however, by themselves provide the means of effective analysis; a computer model is required to effectively implement this planning process. Figure 2 illustrates this concept.

A planning model for a college or university provides an analytical description of meaningful relationships between program activity levels and resources under varying circumstances. With the aid of a computer, particularly in a direct-access environment, demands on each resource can be rapidly computed for a specified program of activities and policy constraints.

The Planning Model

The general approach used in the planning model consists of simulating the utilization of each resource category (e.g., classrooms, faculty, finances) by each program activity (e.g., student instruction, sponsored research) over each of a specified number of future years. Because of the rapid computational capability and the ease of changing data files, a satisfactory plan can be determined by the user through repetitive simulations. The following discussion deals separately with the structure of the simulation model and the computer program.

Structure of the Simulation Model

The simulation model is a deterministic calculation of the end-of-year state of the institution based on forecast environment for that year, planned decisions for that year, and beginning-of-year state of the institution. The end-of-year state variables become the beginning-of-year state variables for the next year's simulation. This process is repeated for each of ten years.

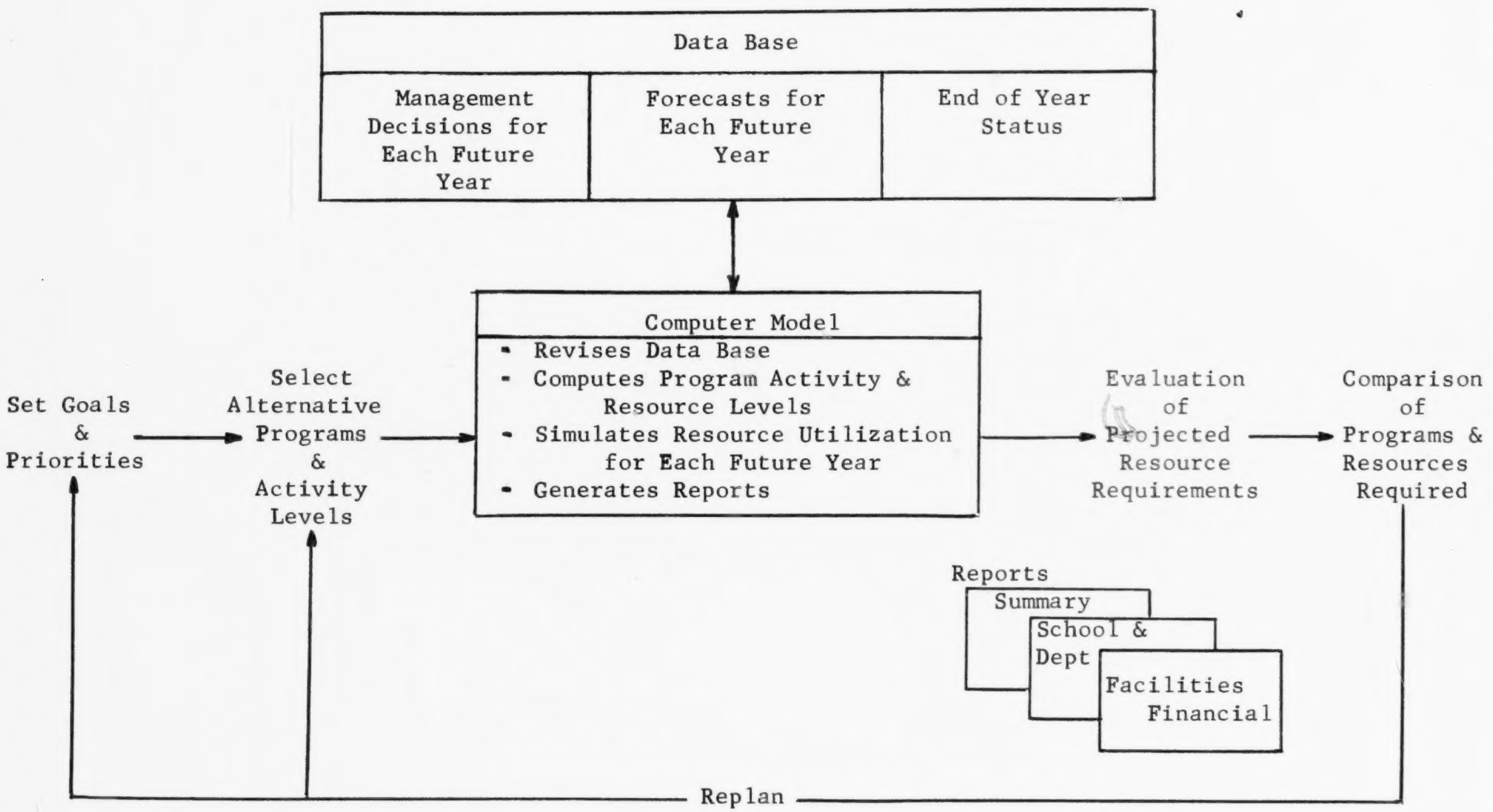
Twenty-one environmental variables were used in the RAPID (Remote Access Planning for Institutional Development) model which was developed for Peat, Marwick, Livingston & Co.'s seminar in Computer-Assisted Planning for Colleges and Universities. It should be noted that these are not all purely environmental; there are actions which the institution could take that would alter some of these variables. For example, the number of applicants can be influenced by changes in tuition and fee charges, room and board charges, curriculum, physical plant, and faculty stature.

Forty-three decision variables were employed in the model. These decisions are intentionally oriented towards specific action-oriented decision rules. For example, the student/faculty ratio is not an actual decision, nor is it an input to the model. A user may desire to have a particular student/faculty ratio and, consequently, decide to make the appropriate adjustments in enrollment and faculty levels to achieve that ratio.

The 165 state variables used to describe the condition of the institution include enrollments, statistical profiles of each student body, curriculum data, average class sizes, faculty utilization, and classroom/laboratory utilization.

Figure 2

Overview of Planning Model


Data Base
Management Decisions for Each Future Year
Forecasts for Each Future Year
End of Year Status
Computer Model
- Revises Data Base
- Computes Program Activity & Resource Levels
- Simulates Resource Utilization for Each Future Year
- Generates Reports
Set Goals & Priorities
Select Alternative Programs & Activity Levels
Evaluation of Projected Resource Requirements
Comparison of Programs & Resources Required
Reports
Summary
School & Dept
Facilities Financial
Replan

The general logic followed in a simulation run is flowcharted in Figure 3. Specific examples of the computations within the model are discussed below.

To achieve the desired freshman enrollment, the model will accept a sufficient number of applicants so that 65 percent of those accepted will approximately equal the number of admissions desired. As it advances classes through the curriculum, the model will promote freshmen to the sophomore class, using an attrition rate which is proportional to the ratio of the number of freshmen accepted to the number of freshman applications. In addition, it will promote sophomores, juniors, and seniors using an attrition rate proportional to prior year rates.

The user decides the number of required and elective courses to add or delete from the program of the freshman, junior, and upper division classes, as well as the maximum class size for each major subject field.

The model determines the number of sections required to teach the enrolled students the number of offered courses by simulating the following scheduling process:

(1) Estimate the number of students enrolling in a course.

(2) Determine the smallest size instructional room that will accommodate all of the students enrolled in the course. If a room is available and maximum class size is not exceeded, schedule one section and use that room. If a room is not available, or maximum class size is exceeded, divide the class into as many sections as are necessary to accommodate the students in the available rooms.

(3) Repeat this process for the next course until all courses are scheduled.

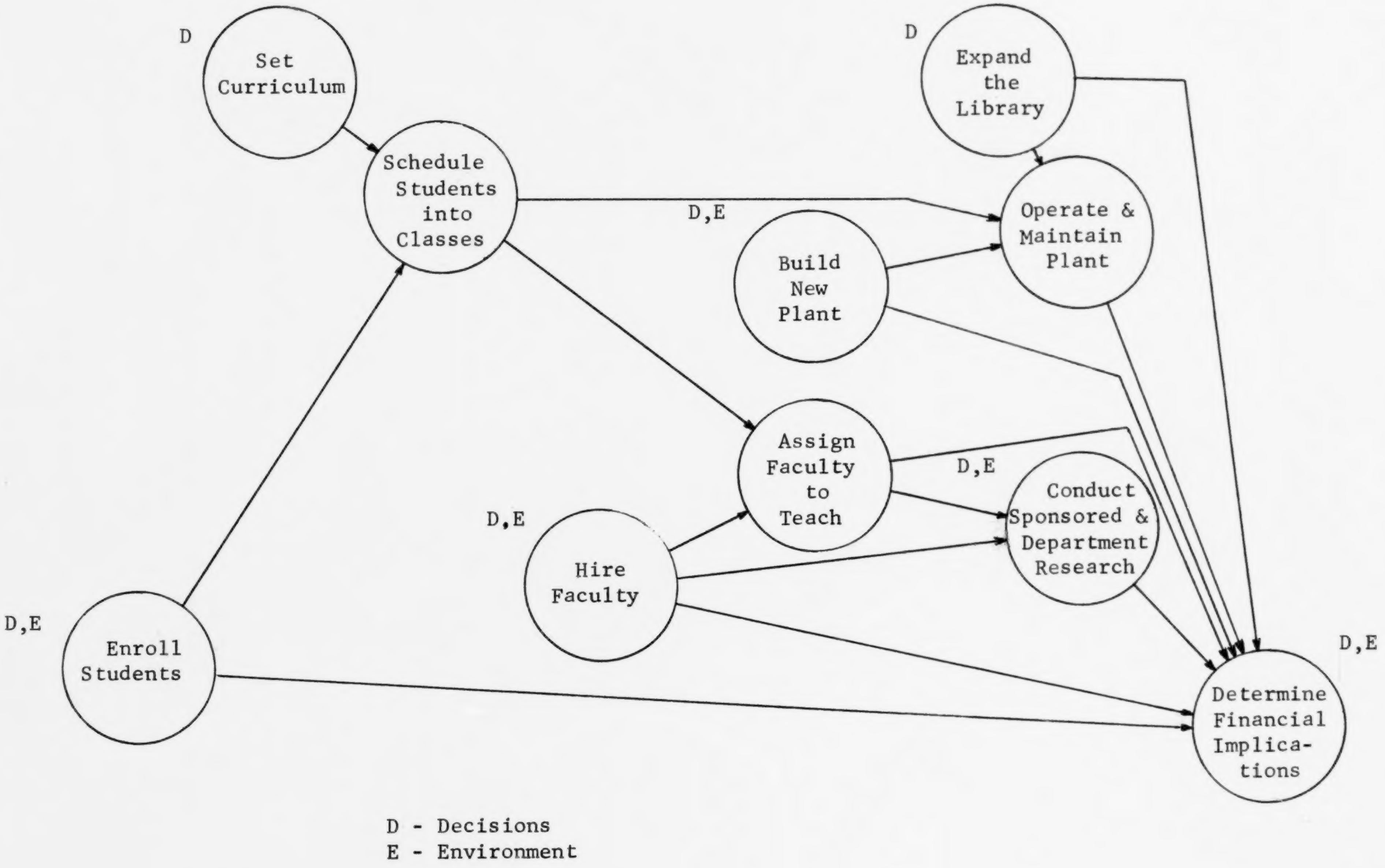
The model ascertains whether there are sufficient faculty members, in addition to those required for teaching, to complete the sponsored research projects already under contract. If there are, it accepts any desired new research projects up to the number of available faculty or the number of sponsored research projects available, as specified by the environment. The model determines the number of faculty required to teach the instructional sections previously computed and to complete the sponsored research projects started in the prior year and start those undertaken in the current year.

The model then compares the faculty required with the faculty available. After the user decides how many faculty to hire in each rank, the model: (1) reduces the number of faculty in each rank according to the environmental attrition rate; (2) determines the number of assistant professors and instructors eligible for promotion; (3) determines how many of the eligible assistant professors and instructors will be promoted; and (4) terminates a fraction of the remaining assistant professors and instructors who were eligible for promotion.

If the user decides to add instruction rooms, offices, residential units, or laboratory stations, the model determines the cost based on the number of different types of buildings being added, the number of units in each type, and a cost-of-construction index as specified in the environment. The cost of a building is spread over time, and the space does not become available until the end of the year following the year in which construction starts.

Figure 3

Logic Flow: University Planning Model



The model calculates the tuition and fee income by multiplying the graduate and undergraduate enrollment by the respective tuition charges, plus a percentage of the total for miscellaneous fees.

Sponsored research expense is computed by multiplying the number of people engaged in sponsored research times their average annual compensation, and the corresponding income is estimated.

The model multiplies the number of faculty assigned to instruction and departmental research times their average total compensation plus benefits, and then adds a proportional amount, adjusted for cost-of-living increases, for supplies, to yield the expenditures for instruction and departmental research.

Library expenditures are calculated by considering the previous year's expenditures adjusted for annual cost increases, the previous year's expenditures adjusted for any increases in the size of the collection, and the amount that must be spent for new volumes to be purchased during the current year.

The model calculates operation and maintenance expenditures by considering the previous year's expenditures adjusted for cost increases, the changes in enrollment, and the changes in the size of the plant.

The Computer Program

The simulation model, along with supporting software, such as a file maintenance and information retrieval capability, was programmed in FORTRAN to operate on an SDS 940 in a time-sharing mode. To facilitate its use by executive-level personnel, the program allows completely free-field input capability incorporated with extensive editing of input data. In addition, the program was given a limited vocabulary to allow English language control command.

The general structure of the computer program is illustrated in Figure 4. The data base consists of four basic files: (1) present state variables, (2) forecast environment for 10 years, (3) planned decisions for 10 years (original), and (4) planned decisions for 10 years (current).

The two sets of planned decisions are maintained to provide the user with the capability of storing two levels of plans: an original, or approved plan, and a current, or experimental plan.

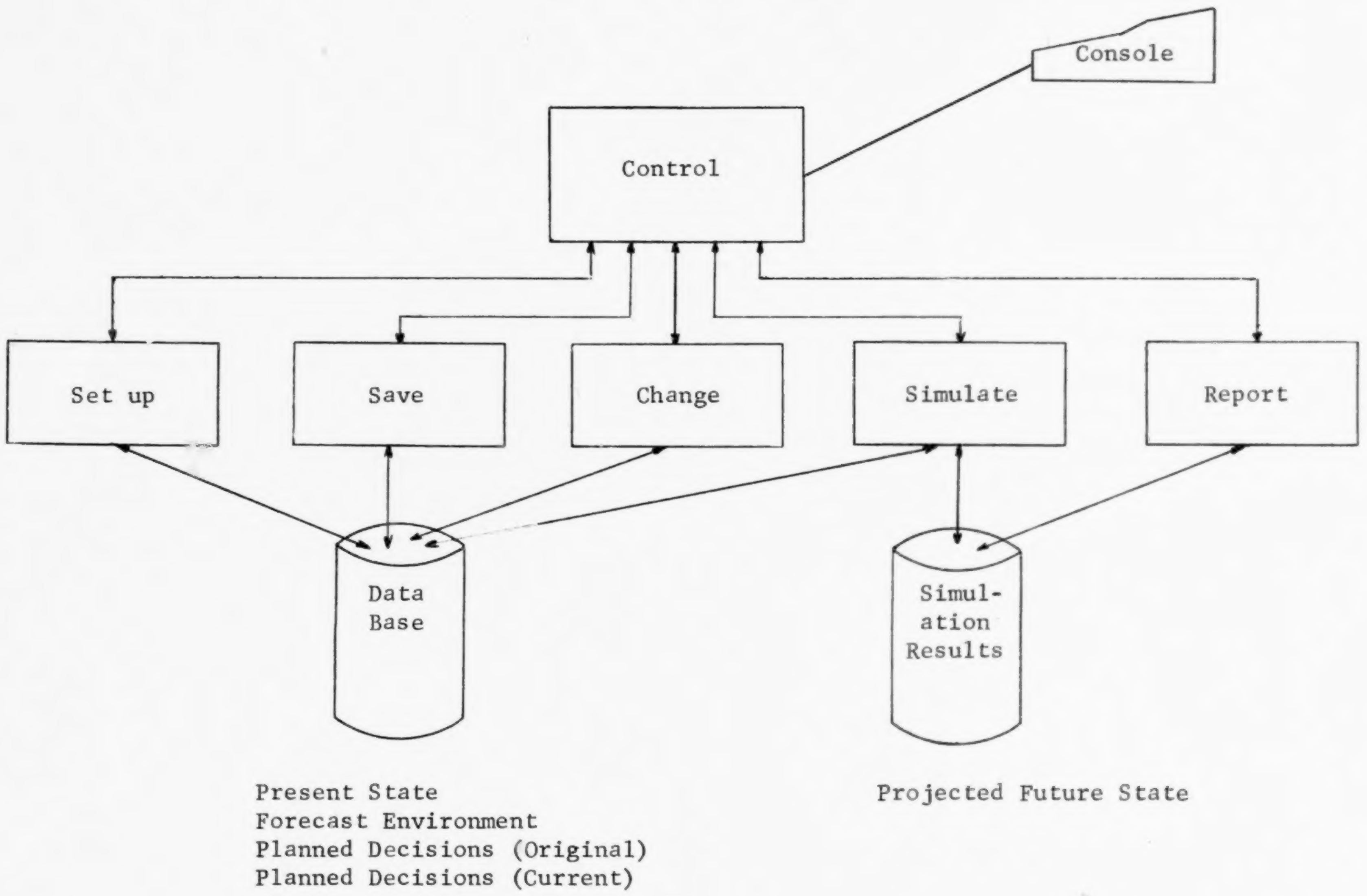
An additional file is kept for the results of the most recent simulation run. The primary reason for storing this data on a disk file rather than in core is to conserve core storage requirements. The program currently requires all but 101 words of the 11,200 words of core storage available under the SDS 940 FORTRAN Operating System. Core overlays are not used in the program, although that capability has now been added to the 940 system.

The RAPID computer program is organized in five major sections: SETUP; CHANGE; SAVE; RUN; and REPORT.

The SETUP section of the model provides the computer with the initial values for each of the 165 initial state variables, values for 43 decisions for each of the 10 years being planned, and values for 21 environmental characteristics for each of the 10 planning years.

Figure 4

Planning Model Structure



The values for the 43 decisions for the 10 years can be selected by the user as either the ORIGINAL values specified in the initial 10-year plan, or the CURRENT values that were used in the most recent 10-year plan simulated.

The CHANGE section of the model permits the user to modify the values for either the DECISION or ENVIRONMENTAL variables for any of the 10 years under consideration. This modification may be accomplished by typing the word "DECISION" or "ENVIRONMENTAL," followed by the variable code number and the year number. The computer then prints out the current value for that variable and requests a new value.

The SAVE section of the model allows the user to save all changes made for decision variables simply by typing "SAVE" after he has entered the changes. This will cause the CURRENT file to be updated for subsequent SETUP's.

The RUN section of the model performs the computations of all 165 state variables for each of the 10 years of the plan, given the set of decision and environmental variables specified by the SETUP and CHANGE sections.

The REPORT section of the model permits the user to select the results he wishes to have printed. There are five different reports which reflect the simulated operation of the university over the 10-year period: SUMMARY, FINANCIAL, FACILITY, Liberal ARTS College, and ENGINEERING College.

Conclusions

The unique features demonstrated by the RAPID model are as follows:

Scope: the simulation, at a summary level, of the interactions between all major programs and resources of an institution.

User-oriented features: the data base organization and ease of communication by nontechnical personnel with data files and the planning model itself.

Implementation on a time-shared computer installation: the ability of the user to receive a rapid response to simulation requests and to maintain continuity in planning and analysis through rapid iterative use of the model.

At least four major benefits can accrue for institutions by using computer-assisted planning methods. First, through the rapid calculation and feedback of information on the probable consequences of decisions, many more alternatives can be evaluated than is otherwise possible. Second, because of the interrelationships among programs, resources, and time periods, the simulated results of planning decisions should provide a more accurate projection of the future than current planning techniques. The model should help establish the feasibility and desirability of a proposed plan. Third, more key people are able to participate simultaneously and directly in the planning process. And last, institution planners, relieved of the burden of extensive calculations, can concentrate on innovative planning.

A MODEL FOR THE PRODUCTION OF COLLEGE GRADUATES

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In this paper an attempt is made to specify the form of a model for estimating the relation between various inputs and outputs of the educational process at the college level. Three factors were critical in shaping the structure of this model. First, some of the variables which represent important inputs to the educational process exert their influence on output in a variety of ways. Thus parental income will influence both a student's precollege preparation and his ability to finance the investment required in the attainment of a college education. In order to develop a model which is useful for policy purposes, it is important to estimate these influences separately.

Second, variables which are inputs to the educational process at the college level are often outputs of earlier stages of the learning process. Thus the academic aptitude of students as measured just prior to college entrance is a function of their formal schooling and home life over the entire 17 or 18 years prior to college entrance. Since alteration of the level and quality of output at the college level may depend critically on the changes in the inputs to the educational process at earlier stages, some of the equations of the model take into account the sequential nature of this process.

Finally, the educational attainment of the last generation undoubtedly exerts a substantial effect on the education of the current generation. Parents' educational attainment influences that of their children both directly (through the transference of attitudes and information) and indirectly (through the relationship between educational attainment and earning potential). Since this intergenerational transfer has important implications for long-run trends in the income distribution and for the potential effectiveness of education as a mechanism for adjusting economic inequalities, I have attempted in this model to trace out as completely as possible the potential effects of parents' educational attainment on the educational success of their offspring.

In the discussion which follows, a number of equations which make up the model being considered will be discussed separately. Independent variables in one equation may appear as dependent variables in another. To avoid subsequent confusion, a consistent notational scheme is introduced here.

X_i denotes the i^{th} exogenous variable in the system. It will have the same notation in every equation.

Y_i denotes the i^{th} endogenous variable in the system.

$Y_i{*}$ denotes the estimated value of Y_i.

β_{ji} denotes the parameter relating the i^{th} exogenous variable to the j^{th} endogenous variable.

γ_{ji} denotes the parameter relating the i^{th} endogenous variable to the j^{th} endogenous variable.

ϵ_j denotes the difference between the actual and the estimated value of the j^{th} endogenous variable. Unless otherwise specified, this variable is assumed to be normally distributed with mean equal to 0 and variance equal to σ^2.

The variables used in the model are drawn from the following list:

Y_1 = The probability of a student with characteristics X leaving the educational system in output category A.

Y_2 = A student's score on an achievement test administered in high school.

Y_3 = A student's average grades in all academic courses in high school.

Y_4 = A student's average score on an academic aptitude test administered in high school.

Y_5 = Average annual expenditure of a student, excluding tuition, while in college.

Y_6 = Average annual income of a student's family while the student is in high school.

Y_7 = Average annual income of a student's family during the period of his college attendance.

Y_8 = Annual income of a student's father at the time of his high school graduation.

Y_9 = Annual income of a student's mother at the time of his high school graduation.

Y_{10} = Average annual income of all males in the occupational category of the student's father.

Y_{11} = Average annual income of all females in the occupational category of the student's mother.

X_1 = Number of years of schooling of student's father.

X_2 = Number of years of schooling of student's mother.

X_3 = Age of student's father (upon student's entrance to college).

X_4 = Age of student's mother (upon student's entrance to college).

X_5 = Number of hours per week student worked while in college.

X_6 = Dummy variable: 1 if student lives at home while in college.
0 if student lives on campus while in college.

X_7 = Number of full-time faculty in category 1 teaching in student's college.

X_8 = Number of full-time faculty in category 2 teaching in student's college.

X_9 = Number of full-time faculty in category 3 teaching in student's college.

X_{10} = Fraction of total college expenditure devoted to organized research.

X_{11} = Expenditure for maintenance and allowance for depreciation on facilities and equipment in student's college.

X_{12} = Number of other students in the college of student in question.

X_{13} = Average aptitude of other students in the college of student in question.

X_{14} = Average aptitude of other students in the high school of the student in question.

X_{15} = Number of other students in the high school of the student in question.

X_{16} = Number of teachers in student's high school.

X_{17} = Expenditure for maintenance and allowance for depreciation on facilities and equipment in student's high school.

X_{18} = Dummy variable: 1 if student's mother works for pay.
0 if student's mother does not work.

Measures of Output at the College Level

In attempting to devise measure of educational output, we have chosen to examine the process as consisting of several alternative and mutually exclusive events which may occur to the student who decides to enter college. Each of these events represents an output of the educational process, but they vary substantially in their desirability. The underlying assumption of our analysis is that the probability of occurrence of these events can be estimated for any particular student as a function of the inputs to the educational process.

The possible outputs of the educational process have been categorized as follows: failing academically and leaving school without a degree; not failing, but leaving school without a degree; graduating and terminating educational investment; graduating and continuing formal schooling in a graduate or professional school.

These divisions were chosen first because they represent educational experiences of sharply different values. Gary S. Becker indicates and our own estimates from census data confirm that people who fail to graduate earn a substantially lower return on their investment than those who carry it through to its completion. Moreover, as Friedman and Kuznets have indicated, people who continue their investment in schooling beyond the college level earn a very reasonable return on their total investment.

Secondly, the monetary rewards aside, these events are clearly of distinguishable merit to the participants in the educational process. Most students who enter college intend to earn a degree and failing out is seen as a distinctly undesirable alternative. Moreover, those students who leave college although they are not failing typically express some dissatisfaction with the process in which they are engaged. By the same token, students who graduate have accomplished at least their most minimal educational objective. Finally, students who go on to graduate school have succeeded well enough in college to be accepted for graduate study, and perhaps more important, are sufficiently satisfied with the process in which they are engaged to extend it further.

The same sorts of judgments are likely to be applied by educators. Many universities measure their output in terms of number of students graduating and most public universities are disturbed to find they have an attrition rate of nearly 50 percent. Moreover, sending students on to graduate or professional schools is viewed by most faculty as a desirable result of the educational process.

It will be useful in the statistical model developed below to view these output categories as a series of dichotomous events. Thus, a student:

1. Fails or does not fail.

2. If the student does not fail, he either graduates or does not graduate.

3. If the student graduates, he goes on to graduate school or he does not.

The methods developed in the theory of binary choice can be used to estimate the probability of each of these successive events as a function of the inputs to the educational process. Presumably the greater the inputs to the educational process, the lower the probability of academic failure. Similarly, given that a student does not fail, these inputs will be positively related to the probability of graduation. Finally, among all graduates, the greater the input to the educational process, the more likely the student is to go on to graduate school. In the discussion which follows, we will use the variable Y_1 to denote the probability of each of these events--failure, graduation, going to graduate school--occurring for a student whose educational program is described by the vector of characteristics X.

The Choice of Inputs

Equation 1 describes the relationship between Y_1 and the inputs to the educational process at the college level.

$$Y_1 = e^{\beta_{10}} Y_2^{\gamma_{12}} [Y_3 - Y_3*]^{\gamma_{13}} Y_4^{\gamma_{14}} Y_5^{\gamma_{15}} X_5^{\beta_{15}} e^{X_6\beta_{16}}$$

$$\cdot X_7^{\beta_{17}} X_8^{\beta_{18}} X_9^{\beta_{19}} X_{10}^{\beta_{110}} X_{11}^{\beta_{111}} X_{12}^{\beta_{112}} X_{13}^{\beta_{113}} \epsilon_1 \qquad [1]$$

This equation includes two sorts of variables. On the one hand, there are those characteristics and resources which the student brings to the educational process. These have been determined prior to college entrance in a manner in part described by other equations of this model. The remaining variables describe the resources which the educational institution brings to bear on each student. In using a multiplicative functional form for this equation, we have assumed that while these categories of input are substitutes, they are not perfect substitutes. Thus, while it seems reasonable to assume that the educational attainment of a student is enhanced by additional expenditure, the extent of the improvement is likely to be positively related to the student's own resources of time and talent. If these talents are sufficiently low, moreover, additional expenditures are likely to be fruitless; by the same token, even the brightest student will fail to develop if no resources are devoted to his education. The other features of this functional form (notably, constant elasticity), while intuitively plausible, have been chosen for statistical convenience.

With this in mind, we turn to an explicit consideration of the variables used as inputs in Equation 1, the college production function. Each student enters the educational process with certain attributes which are related to academic success. Variables Y_4 and Y_2 reflect measures of the attributes using tests of "aptitude" and "achievement." There is, of course, substantial dispute among psychologists as to whether one can legitimately distinguish between these two measures. Some of this debate focuses on the relative innateness of the characteristics measured by these tests. In this model, however, both aptitude and achievement are viewed as acquired characteristics. On the other hand, it does seem reasonable to distinguish between a student's acquisition of knowledge (the achievement test) and his acquisition of reasoning ability (academic aptitude). While these will be closely correlated, it is possible to acquire one to a greater degree than the other, and they may well exert separate effects on the production of college output.

There are a variety of tests which purport to measure aptitude or achievement and evidence from previous studies suggests that there may be wide variance in the predictive efficiency of alternative tests. The data set on which this study will be based contains scores on an extensive battery of tests which varied in subject matter and the form in which they were administered. In the actual estimation of the model, a number of alternative combinations will be used to obtain some indication of the factors related to efficient testing procedure.

Of course, at best these test scores are not going to be complete measures of a student's ability to perform in an academic environment. The degree of motivation with which a student approaches the educational process will also be an important factor. One way of estimating this factor is by examining a student's previous performance in a similar environment. Where a student of apparently modest aptitude achieves good high school grades, we are prone to argue that he was highly motivated to work hard in high school. Similarly, when a student of high aptitude performs poorly in high school, this may be attributed to low motivation. Whatever the reason for these differences in motivation in high school, there is a great amount of accumulated evidence that these effects continue into college. This may explain the fact that high school grades are generally a better predictor of success in college than aptitude scores. Reflecting this factor, we have included an equation in our system which attempts to explain a student's high school grades as a function of the student's aptitude, socioeconomic status, and the aptitude of others in his high school (see Equation 3 which is described in greater detail below). For each student the difference between actual high school grades and those which would be predicted on the basis of this relationship is taken as an estimate of motivation and included as the third input (Y_3 - Y_3*) to our college production function.

To quote from an article on dropouts by John Summerskill: "At the core of the social and emotional complexities of the college situation, there is a job of work for which the student must have sufficient prior training and sufficient ability." In addition to these attributes, success in college requires a substantial investment of the student's time in an environment which is conducive to study. Other things being equal, the greater a student's financial resources while in college, the greater the student's ability to create such an environment. Thus we have included a variable (Y_5) which reflects the student's estimate of his average annual expenditures in college. This estimate excludes payments for tuition and fees, because these are reflected in measures of the institutional contribution to the student's education. Where the student lives at home, his estimated expenditures have been augmented by an allowance for the cost of room and board.

To some extent the student's income while in college may be augmented by part-time work. While the income derived in this way improves the student's environment, the time spent working reduces the time and energy available for study. This reduction of available time is reflected in variable X_5 which measures the hours per week the student works for pay while in college.

Even consistently accounting for the expenditure patterns of students who live at home and those who live at school, there may be important differences in the environment of these two groups. It is not clear what the effect of this variable is. The student who lives at home spends less time providing for his own well-being and hence has more time for study. On the other hand, he has less contact with the intellectual community provided by college life. In any case, it seemed useful to test the often advanced hypothesis that living at home exerts a consistent influence on success in college. To this end, we have included the variable X_6 which takes on the value one if the student lives at home and zero if he lives away from home.

The remaining variables reflect the resources brought to bear by the college. These can be divided into three categories--faculty, facilities, and other students. Our faculty input is measured in terms of the number of full-time equivalent faculty resident at the college in each of three categories (variables X_7, X_8, and X_9). These divisions are intended to reflect broad divisions of teaching quality and, given the data, perhaps the best measure of these differences is rank of faculty. Category 1, for example, could be tenured faculty; category 2, untenured faculty; and category 3, the remainder of the instructional staff including teaching assistants, lecturers and instructors.

At many colleges and universities a substantial percentage of faculty time is devoted not to teaching but to research. The effect of this on undergraduates is unclear. On the one hand, research undoubtedly reduces the time available for teaching. It may, however, improve the quality of instruction in the time that is spent. The net direction of this effect is measured by the inclusion of variable X_{10} which reflects the percentage of total university expenditure devoted to organized research. While organized research is by no means a complete accounting of all research done at a campus, it is likely that among the colleges considered, this measure varies closely with total research expenditures.

The facilities used by students are measured by the total expenditures of the institution for the maintenance and operation of facilities and equipment plus estimated depreciation on the book value of plant and equipment (variable X_{11}). This measure suffers from a number of deficiencies. In particular, plant and equipment may be carried on an institution's books at values which are only indirectly related to the value of these resources in production. On the other hand, given the broad range of colleges being examined in this study, this variable may still be reflective of variation in the general quality of university facilities.

The resources described by variables X_7 to X_{11} must be shared with other students, the number of which is indicated by variable X_{12}. Other things being equal, the more students with whom a given bundle of resources is shared, the less the resources are devoted to any particular student. Other students are included as a separate variable (rather than simply dividing all institutional resources by the number of students) because the effect of increasing the number of students may, in fact, be different from the effect of decreasing total resources by a corresponding amount. Moreover, number of students provides a good measure of the scale of the institution.

Finally, variable X_{13} reflects the average quality of the other students at a particular college. In the absence of a better measure, this "quality" is measured by the average rank of these students in their high school graduating class. Average quality of the student body will exert two distinct effects on college output. To some extent, the educational process is a competitive one. This is particularly the case in the determination of academic failure and to a lesser extent in structuring the probability of graduation of those students who do not fail. In this context, a student's aptitude and achievement must be measured relative to that of other students competing for the same degrees. Presumably, the higher the average level of student quality at a college, the higher the probability of any particular student failing and for those not failing, the lower the probability of graduating.

On the other hand, the quality of the intellectual experience which a college offers any particular student depends critically upon the quality of the other students at the college. The intellegence and prior educational achievement of the students as a group is a resource upon which each student can draw in furthering his own intellectual aspirations. This positive influence is likely to be reflected in the probability of a college graduate continuing his education. Since his undergraduate experience was stimulating, the student graduating from a college with high entrance standards is likely to seek to continue his education. By the same token, he is also more likely to be admitted than students from colleges with less restrictive entrance standards.

The Determination of Student Characteristics

The student characteristics which are inputs to the educational process are the outputs of the process of educational development occurring prior to college entrance. In each year after birth, individuals acquire knowledge and reasoning ability. A student's increase in ability and knowledge in any period will be a function both of the information and aptitude acquired in previous periods, as well as the current level of resources invested in this activity. If we had sufficient data, presumably we could trace out, via a series of production processes, the manner in which a student's academic characteristics upon entering college were acquired. For illustrative purposes it will be sufficient to trace this process back through the period of the student's enrollment in high school. Additional extensions would be similar in form if not in detail.

The equations describing the production process at the high school level are indicated below.

$$Y_2 = e^{\beta_{20}} Y_4^{\gamma_{24}} Y_6^{\gamma_{26}} X_1^{\beta_{21}} X_2^{\beta_{22}} e^{X_{18}\beta_{218}} X_{14}^{\beta_{214}} X_{15}^{\beta_{215}} \cdot X_{16}^{\beta_{216}} X_{17}^{\beta_{217}} \epsilon_2 \qquad [2]$$

$$Y_3 = e^{\beta_{30}} Y_4^{\gamma_{34}} Y_6^{\gamma_{36}} X_1^{\beta_{31}} X_2^{\beta_{32}} e^{X_{18}\beta_{318}} X_{14}^{\beta_{314}} \epsilon_3 \qquad [3]$$

$$Y_4 = e^{\beta_{40}} Y_6^{\gamma_{46}} X_1^{\beta_{41}} X_2^{\beta_{42}} e^{X_{18}\beta_{418}} X_{14}^{\beta_{414}} X_{15}^{\beta_{415}} \cdot X_{16}^{\beta_{416}} X_{17}^{\beta_{417}} \epsilon_4 \qquad [4]$$

The three variables used as outputs of the educational process at the high school level--aptitude and achievement scores measured at the end of the high school process and average grades in high school--can be expressed as functions of similar sets of inputs to the educational process at the high school level. Moreover, many of the inputs are conceptually identical to those used to estimate output at the college level. Variables X_{15} to X_{17} measure institutional resources at the high school level in the same manner as variables X_7 to X_{11} assessed the resource contribution of colleges. The model, however, is less detailed in assessing the role of qualitative differences among high school than among college faculty. Moreover, variables X_{15} to X_{17} have been omitted from Equation 3 because the dependent variable in that function, high school grades, is a relative measure of performance. Presumably an increase in the quality of faculty or facilities will increase the performance of all students and thus leave relative measures of student performance unchanged. While we have also included a variable which reflects the average aptitude of all students in each high school, the effect of this variable on aptitude and achievement scores in high school will differ from its effect on output at the college level. Since these scores are, for the students in any one high school, absolute measures of performance, the average aptitude of students in that high school should exert a positive effect on each student's achievement on these tests. The higher the average level of aptitude, the better the intellectual climate of a school and hence the higher the performance of all its students. On the other hand, the effect of average aptitude on high school grades will, in all likelihood, be negative. Since grades are a relative measure of performance, the process by which they are acquired is a competitive one. The higher the average quality of the competitor the more difficult it will be for any student to achieve high grades.

Whereas the educational process described in Equation 1 depends largely on the student's own resources, that in Equations 2 to 4 explicitly includes measures of family characteristics. As the student grows older and increases the level at which education is pursued, the amount which his family status can contribute directly to the student's educational performance is likely to diminish. At the high school level, since the student is still living at home, the effect of the family environment may still be quite important. To reflect the variations in the home environment of the student, parents' income (Y_6) and parents' education (X_1 and X_2) are included as inputs to the educational process at the high school level. The ability of parents to aid in the educational process of their children is assumed to depend upon their own educational attainment and their ability to purchase the attributes of a home life conducive to educational achievement. Thus, even if parents are not themselves well-educated, high income will enable them to provide their children with books, a place to study, and a neighborhood environment in which a high value is placed on educational attainment. Since the effect of parents' educational level on the educational attainment of their children will depend on contact, we have included a parameter which reflects whether or not the student's mother works for pay. If she does, this will increase the family income, but at the expense of some contact with her children.

In addition to its effect on college preparation, parental income is an important determinant of a student's financial position while in college. Since it is important to assess the total effect of socio-economic status on college output, Equation 5 expresses the relationship between parental income and the financial resources available to the student while in college.

$$Y_5 = e^{\beta_{50}} \; Y_7^{\gamma_{57}} \; \epsilon_5 \qquad [5]$$

Thus, in this model, the total effect of parents' socio-economic status on college consists of its effect on precollege preparation plus its effect on the student's financial circumstances while in college.

If we wish to ameliorate the effect of family background on financing college education (and thereby reduce one cause of college attrition among the children of low-income families), it would be necessary to establish a loan or subsidy program for these students. Overcoming the more pervasive and far-reaching effects of family background on the learning environment in which the student grows to maturity would require a substantial alteration of the level and direction of expenditure on public education. Since these two alternatives are likely to differ rather sharply in their effectiveness and feasibility, it is critical that the model be capable of keeping them separate.

The model previously described permits the examination of a number of issues which are of critical importance to educational administrators and to legislators concerned with educational policy.

1. At the simplest level it provides a means for tracing out the implications for the efficiency of operation of alternative college entrance policies. Given the substantial evidence that a partial college education is not a profitable investment, colleges may wish to see if they can alter their entrance policies to reduce college attrition.

2. From preliminary research it is clear that the selection of students with a high probability of graduation would tend to make college a perquisite of the wealthy and the well-bred. Since education is often touted as a means for redressing income inequality, educational administrators may wish to consider the costs of operating at some level of efficiency subject to a constraint on the socio-economic status of entrants. We could, for example, determine the redistribution of resources at the high school level which would be required to assure that students from all socio-economic groups have an equal chance of successfully completing a college education. Alternatively, we could consider the cost of assuring the equality of opportunity by redistributing resources at the college level.

3. Finally, given the substitutability between the educational characteristics students acquire prior to entry and educational expenditure at the college level, there remains some question of the most efficient form for this expenditure. Can attrition be reduced most easily by increasing faculty-student contact or by improving facilities and equipment? Would an increase of faculty at the assistant professor level be more or less effective than an increase in the number of tenured positions? What would be the effect of increasing expenditures on research? While it would admittedly be difficult to draw firm conclusions, given the differences in technology among colleges, from the sort of function examined here, the results will be suggestive of direction for future research.

Income Determination and Inter-Generational Transfer

Equations 1 to 4 enable us to trace the direct effects of parents' educational attainment on the college persistence of their offspring. However, education is also an important determinant of parents' level of income and therefore exerts an indirect influence on college persistence as well. Equations 6 to 11 enable us to trace out more completely the effects of the educational attainment of one generation on that of the next.

Equations 10 and 11 indicate the relationship between educational attainment and occupational choice. If we rank occupations by their mean income, we will generally find that the higher the income level of an occupation, the higher the average level of education of entrants to that occupation. This reflects both the high educational standards of high-income occupations as well as the relatively narrow applicability of high levels of education in low-income occupations.

$$Y_6 = \int_{t=x_3-4}^{t=x_3} Y_8{*} + \int_{t=x_4-4}^{t=x_4} Y_9{*} \tag{6}$$

$$Y_7 = \int_{t=x_3}^{t=x_3+4} Y_8{*} + \int_{t=x_4}^{t=x_4+4} Y_9{*} \tag{7}$$

$$Y_8 = e^{\beta_{80}} Y_{10}^{\gamma_{810}} X_1^{\beta_{81}} X_3^{\beta_{83}} \epsilon_8 \tag{8}$$

$$Y_9 = e^{\beta_{90}} Y_{11}^{\gamma_{911}} X_2^{\beta_{92}} X_4^{\beta_{94}} \epsilon_9 \tag{9}$$

$$Y_{10} = e^{\beta_{100}} X_1^{\beta_{101}} \epsilon_{10} \tag{10}$$

$$Y_{11} = e^{\beta_{110}} X_2^{\beta_{112}} \epsilon_{11} \tag{11}$$

While Equation 10 expresses this relationship for men, in Equation 11 we have described a similar relationship for women. Although the same general mechanism is likely to be applicable in both cases, the relationship between occupation and education is generally weaker for women. Obtaining the average income level of specific occupations from Census data, we could estimate this relationship by comparing the occupational and educational categories of the parents of our sample of students.

Having determined the impact of educational attainment on occupational choice, the occupation, education and age of a student's parents are used to estimate the income of the student's father and mother. It has generally been observed that the distribution of incomes within any occupation is positively related to both education and age (when income is adjusted for growth). The lower the income level, the smaller the effect of both these variables. If these equations (8 to 11) can be estimated from data on the parents of the students in our sample, the total effect of education on income could be determined. It would consist of the product of the impact of occupational choice on income and the impact of education on occupational choice plus the effect of education on income holding occupational attainment constant. From this information we could trace out the total effect of parents' educational attainment on the educational attainment of their offspring.

Previous studies have indicated that students have rather poor notions of parental income, although they report the age, education and occupation of their parents with tolerable accuracy. This suggests that Equations 8 and 9 should be estimated from data supplied directly by parents. This also indicates an additional use of these equations. We can use the estimated parental income which could be derived from the parameters of these equations and data on parental age, occupation and education as a substitute for the student's own assessment of parental income.

Over the period (typically 8-9 years) that a student is in high school and college, his family income may change substantially. For the sake of precision, the income estimates used in Equations 2 to 5 should be derived by integrating Equations 8 and 9 over the periods involved. This is indicated in Equations 6 and 7.

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SOME EXPERIENCES WITH COMPUTER APPLICATIONS TO CAMPUS PLANNING

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A major purpose of this paper is to discuss some peripheral matters relating to the development and use of simulation models. Before an institution decides to invest much time or money in a simulation model or models, a great deal of thought should be given to a host of related matters, including: the need to relate the model to the total university record-keeping methods, academic and financial planning, systems and procedures, and other institutional research studies. Looking ahead, careful attention should be given not only to the entire system of definitions and classification of data within the institution, but also to what changes may be necessary in the future to properly relate the system of classification of data to systems on a state-wide, regional, and national basis. For a simulation model to be most useful and effective, it should be thought of within the context of the entire university planning process and closely integrated into that process rather than being thought of as an isolated project.

Student/Space/Density Relationships

The conceptual foundation for current work at the University of Washington leading toward the development of a planning simulation model was laid some five years ago with the preparation of a diagram of student/space/density relationships (see Figure 1). This diagram was partially prepared in order to illustrate the complexity of the answer to the simple question: "How many students do we have room for on campus?" The diagram illustrates that in order to answer the question of "How many students?" many kinds of prior questions must be answered, such as: (1) What is to be the student mix by level and discipline? (2) What standards are to be used for rate of utilization of instructional space? (3) What standards are to be used for size of faculty offices, number of volumes per square foot of library space, percentage of student body to be provided seating space in library study areas, percentage of student body to be provided cafeteria seating? (4) What proportion of the student body is to be housed in University-owned dormitories and thus what proportion of land area must be reserved for housing rather than academic uses? (5) What are the off-campus trends regarding housing and public transportation and their likely impact on parking demand and resulting amount of land area which must be reserved for parking?

In addition to helping to clarify thinking regarding some of these academic and physical planning relationships, the chart also proved to be helpful in setting the pattern, priorities, and relationships between other long-range planning studies undertaken by the Long-Range Planning Office.

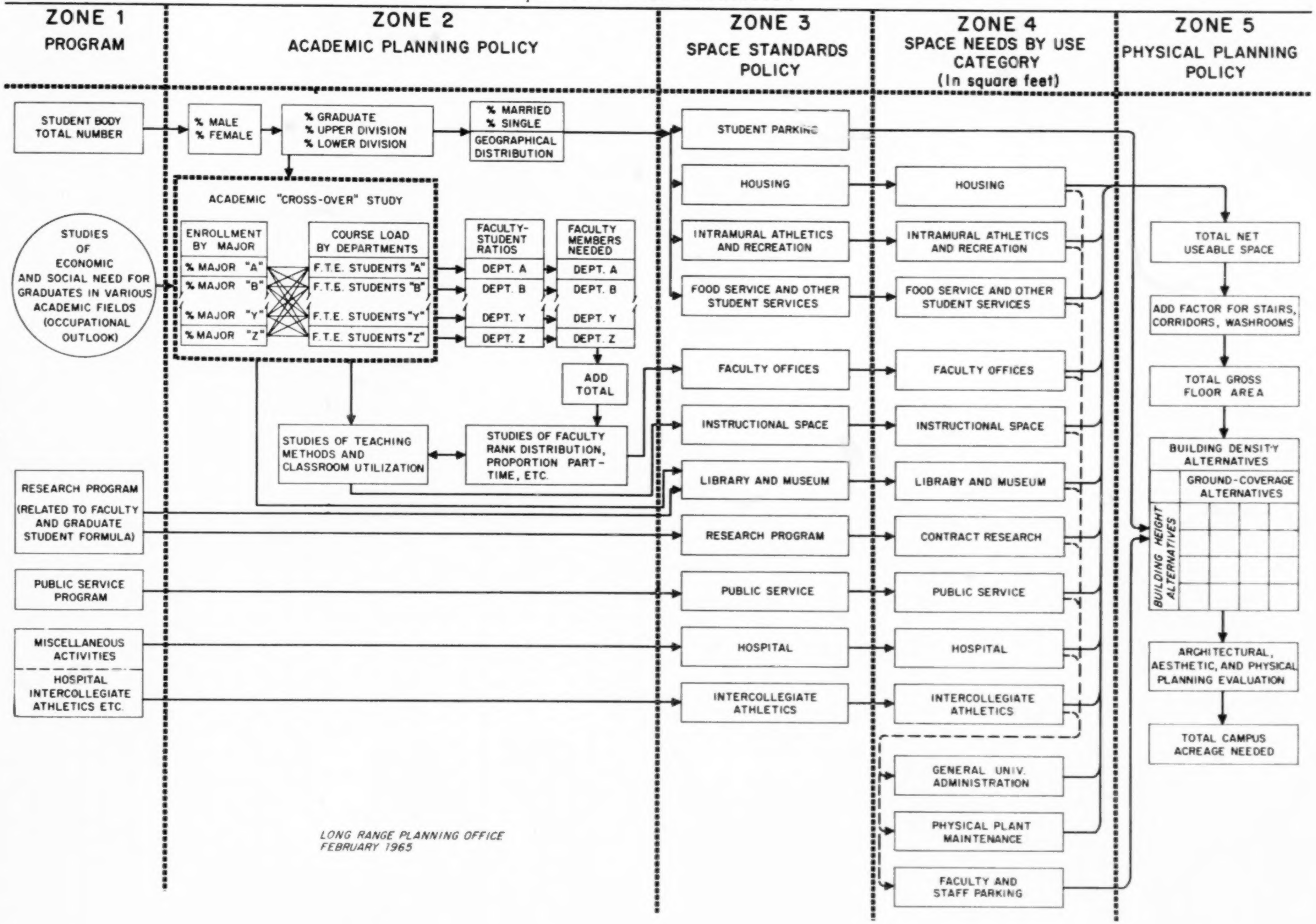
Program Planning

Turning for a moment to a recent development in the fields of planning and budgeting, that of Planning-Programming-Budgeting Systems (PPBS), or "Program Planning," some pertinent basic concepts are found. Program planning implies a careful definition of the various programs that an institution considers its mission. There appears to be a tendency in educational institutions to consider the various administrative and budgetary units, such as the Physics Department

Figure 1

DIAGRAM OF STUDENT / SPACE / DENSITY RELATIONSHIPS

UNIVERSITY OF WASHINGTON


ZONE 1
PROGRAM
ZONE 2
ACADEMIC PLANNING POLICY
ZONE 3
SPACE STANDARDS POLICY
ZONE 4
SPACE NEEDS BY USE CATEGORY (In square feet)
ZONE 5
PHYSICAL PLANNING POLICY
STUDENT BODY TOTAL NUMBER
STUDIES OF ECONOMIC AND SOCIAL NEED FOR GRADUATES IN VARIOUS ACADEMIC FIELDS (OCCUPATIONAL OUTLOOK)
RESEARCH PROGRAM (RELATED TO FACULTY AND GRADUATE STUDENT FORMULA)
PUBLIC SERVICE PROGRAM
MISCELLANEOUS ACTIVITIES
HOSPITAL INTERCOLLEGIATE ATHLETICS ETC.
% MALE % FEMALE
% GRADUATE % UPPER DIVISION % LOWER DIVISION
% MARRIED % SINGLE
GEOGRAPHICAL DISTRIBUTION
ACADEMIC "CROSS-OVER" STUDY
ENROLLMENT BY MAJOR
% MAJOR "A"
% MAJOR "B"
% MAJOR "Y"
% MAJOR "Z"
COURSE LOAD BY DEPARTMENTS
F.T.E. STUDENTS "A"
F.T.E. STUDENTS "B"
F.T.E. STUDENTS "Y"
F.T.E. STUDENTS "Z"
FACULTY-STUDENT RATIOS
DEPT. A
DEPT. B
DEPT. Y
DEPT. Z
FACULTY MEMBERS NEEDED
DEPT. A
DEPT. B
DEPT. Y
DEPT. Z
ADD TOTAL
STUDIES OF TEACHING METHODS AND CLASSROOM UTILIZATION
STUDIES OF FACULTY RANK DISTRIBUTION, PROPORTION PART-TIME, ETC.
STUDENT PARKING
HOUSING
INTRAMURAL ATHLETICS AND RECREATION
FOOD SERVICE AND OTHER STUDENT SERVICES
FACULTY OFFICES
INSTRUCTIONAL SPACE
LIBRARY AND MUSEUM
RESEARCH PROGRAM
PUBLIC SERVICE
HOSPITAL
INTERCOLLEGIATE ATHLETICS
HOUSING
INTRAMURAL ATHLETICS AND RECREATION
FOOD SERVICE AND OTHER STUDENT SERVICES
FACULTY OFFICES
INSTRUCTIONAL SPACE
LIBRABY AND MUSEUM
CONTRACT RESEARCH
PUBLIC SERVICE
HOSPITAL
INTERCOLLEGIATE ATHLETICS
GENERAL UNIV. ADMINISTRATION
PHYSICAL PLANT MAINTENANCE
FACULTY AND STAFF PARKING
TOTAL NET USEABLE SPACE
ADD FACTOR FOR STAIRS, CORRIDORS, WASHROOMS
TOTAL GROSS FLOOR AREA
BUILDING DENSITY ALTERNATIVES
GROUND-COVERAGE ALTERNATIVES
BUILDING HEIGHT ALTERNATIVES
ARCHITECTURAL, AESTHETIC, AND PHYSICAL PLANNING EVALUATION
TOTAL CAMPUS ACREAGE NEEDED

LONG RANGE PLANNING OFFICE
FEBRUARY 1965

or the English Department, as programs. I feel that a better approach for planning purposes is to be primarily concerned with the classification of a student by his major and ultimately the degree that he receives, and secondarily with studies of course loads of instruction on a departmental level. In other words, the "output" within a PPBS approach, should be students receiving degrees, not credit hours of instruction by teaching department. The basic instructional program, therefore, should be defined by major and level of degree. Thus a bachelor of arts in English, a master of architecture, and a doctor of musical arts are all academic programs. A Physics Department is not an "academic program" but is merely a convenient budgetary and administrative unit created to serve not only a significant portion of the teaching responsibilities for physics majors but also to serve chemistry majors, engineering majors, and others.

Analytical Studies

With this basic framework in mind, a strong direction and orientation was indicated for two types of analytical studies undertaken at the University of Washington:

1. A preliminary "academic crossover" study was undertaken to relate students' majors to the resulting teaching load on academic departments, for it was realized that if it is necessary to administer and budget by departmental groupings, some means would be necessary to translate academic degree programs into these departmental groupings. This was done by processing all student records for a given quarter through the computer and involved a very tedious programming effort. While we are not yet completely satisfied with the form of the output, we feel it was a worthwhile initial effort.

2. A series of "Occupational Outlook" studies were prepared for certain disciplines as one input factor into the determination of the future "student mix" of the University by teaching program. Other factors studied were patterns of student migration and curricular offerings at other colleges and universities in the Pacific Northwest.

The Concept of a Simulation Model

With this amount of experience and thought about the diagram of student/space/density relationships, it was decided to proceed further toward the development of these ideas into a simulation model of relationships between student academic programs and resulting space needs by various categories of space. Development of such a model was seen as an important academic, physical, and financial planning tool.

The model was conceived as consisting of a series of programs to provide period-by-period estimates of future land, building, and staff requirements under various assumptions as to character of student body, educational policies, level of research activity, level of service to the community, and character of buildings. It was intended that the computer program be capable of taking projections of variables which affect staff and facilities requirements and produce estimates of requirements at any projected time in the future. This would then provide the opportunity to observe the effects of different projections of external variables and also provide an opportunity to manipulate those variables which can be controlled to see how requirements are altered. In other words, it should facilitate the answering of "What would happen if. . ." type questions.

Data Weaknesses

As the work on the project shifted from development of a conceptual scheme to study student/space/density relationships to the analysis of the form and characteristics of the necessary input data, it was found that definite weaknesses existed in the form and content of such data.

The data problem may be said to consist of three major parts: (1) lack of continuity in the form in which data is kept over a period of time or in the system of classification of data; (2) lack of compatibility in systems of classification and units of measurement of data between institutions and between various parts of the same institution; and (3) lack of availability of data. In some cases the data was not available at all or was available in an unusable form. In other cases it was available but was not on punch cards or computer tape and had to be converted to a form which could be easily and quickly stored in the computer. And finally, some of the data was on punch cards but recorded in a way that made it usable only for simple printings and listings. If such data is to be used for computing purposes, many complicated adjustments must be made to organize it for this use.

Experience with the above problems has led to the conclusion that universities should place greater emphasis on the maintenance of data in a form which allows maximum flexibility for new applications, yet keeps a high degree of consistency and uniformity in systems of classification.

Work at the University of Washington has therefore, of necessity, shifted and expanded somewhat from the original concept of the student/space/density relationships model. A considerable amount of effort has been devoted to investigation of broader questions of the general university data problem, systems approaches, computer capabilities, implications for general university information dissemination, university administrative practices, and related matters.

Applications to Other Colleges and Universities

With this idea in mind that other colleges and universities were facing similar problems, and that any developmental work undertaken at this University might prove to be of widespread value, a proposal was prepared for financial support from the Esso Education Foundation. Basic criteria in the proposal included the following: (1) the need to develop methods and necessary computer programs which would be usable by other colleges and universities, an obviously more difficult task than constructing custom programs to serve only the University of Washington; (2) the need to create an approach sufficiently dynamic and flexible to meet the needs of a university that is changing its record-keeping techniques; (3) the need to create methods that will facilitate interinstitutional comparisons and the provision of data required or requested by outside agencies; and (4) the desirability of creating methodologies and programs which will spare other schools and institutions the need to duplicate the extensive developmental work undertaken at the University of Washington and which will make most efficient use of their scarce technical computer personnel.

The immediate reason for developing a management-planning model of this scope is its usefulness as a tool for college and university administrators. Planners and their staffs at universities and colleges should learn to communicate regularly with computers to obtain information and to test the probable consequences of alternative courses of action. Further, planners can spend very little time in technical preparation for such direct communication with the computer. Heretofore, only technical computer personnel, with their professional techniques and vast technical knowledge, had the necessary training for such direct communication. In order to bridge the gap, it is important that much of the routine work of the technical computer personnel be taken care of automatically within the computer.

Objectives of Project

As evolved, the current total design objectives of the project are to provide a user-centered and -oriented tool that is:

1. Applicable not only to schools that can afford a special data-processing staff for planning applications, but also to smaller and private colleges which at most can only afford computer time-sharing communication by a remote terminal.

2. Designed in a computer language (COBOL) that is not tied to any computer or manufacturer of computer machines. The language instructions should be capable of running on nearly any "third generation" random-access processing medium- to large-scale computer.

3. Self-instructive, alterable, and maintainable by people who spend most of their time in efforts not connected with computers (except for initial setup which should be by professional programmers).

4. Easily applicable to the needs and problems of planning staffs and planning and research committee personnel.

5. Capable of providing a ready, coordinated data storehouse of past and present planning data and simulated or real projections for the future. Whether the user's information needs are general or very specific, he should be able to explore or construct the data in depth without being subjected to the arbitrary summarization of indexors or abstractors of data systems.

6. Capable of providing reports to management by remote terminal, high-speed printer output, or by graphic charts that can be custom tailored. The nontechnically trained user of a remote terminal should be able to develop new programs and applications, easily creating, editing, correcting, updating, and storing programs from the remote terminal.

Thus, in summary, the objective is to provide a planning tool administratively and not technically oriented, a tool that is capable of coping with the changing data needs of a dynamic university or college.

International Business Machines and other computer manufacturers have or are working on a number of standardized programs to accomplish many of the objectives that have been expressed. These may be called "General Information Systems" or "Management Information Systems." The distinction between these industry-produced programs and the work of this project is that the former are prepared for a specific type of machine and use a computer language understood only by that machine. The master program to be produced as a part of this project, on the other hand, is written in COBOL-65 computer language which is universally understood by all major computers and is tailored to the information needs of higher education, of both large and small schools alike. The master program seeks to interpret in a uniform manner input from various schools--input data which may be organized in a wide variety of ways--without detailed, individual, technical reprogramming to reconcile differences in record-keeping.

Computer Program Relationships

The various interrelated computer programs are shown in Figure 2. A brief summary of their various functions is as follows:

Computer File Creation--The basis for the planning and simulation process is the creation of a data bank of cross-classified and summarized information drawn from such source records as student master files and space inventory records. This part of the project consists of two phases: (a) development of the classification scheme, and (b) "loading" the computer files with actual data.

Generation of Reports--Computer programs are being written to facilitate the creation of reports desired by the user. Since analyses of future requirements for planning purposes require extensive tabulation in varied format, a "report generator" (a higher level computer program) will permit rapid output of data in a form suitable for analysis without requiring the writing of a complicated computer program in each case. The user will merely specify the form most useful to him, and the "report generator" will supply the detailed computer program which will produce the report.

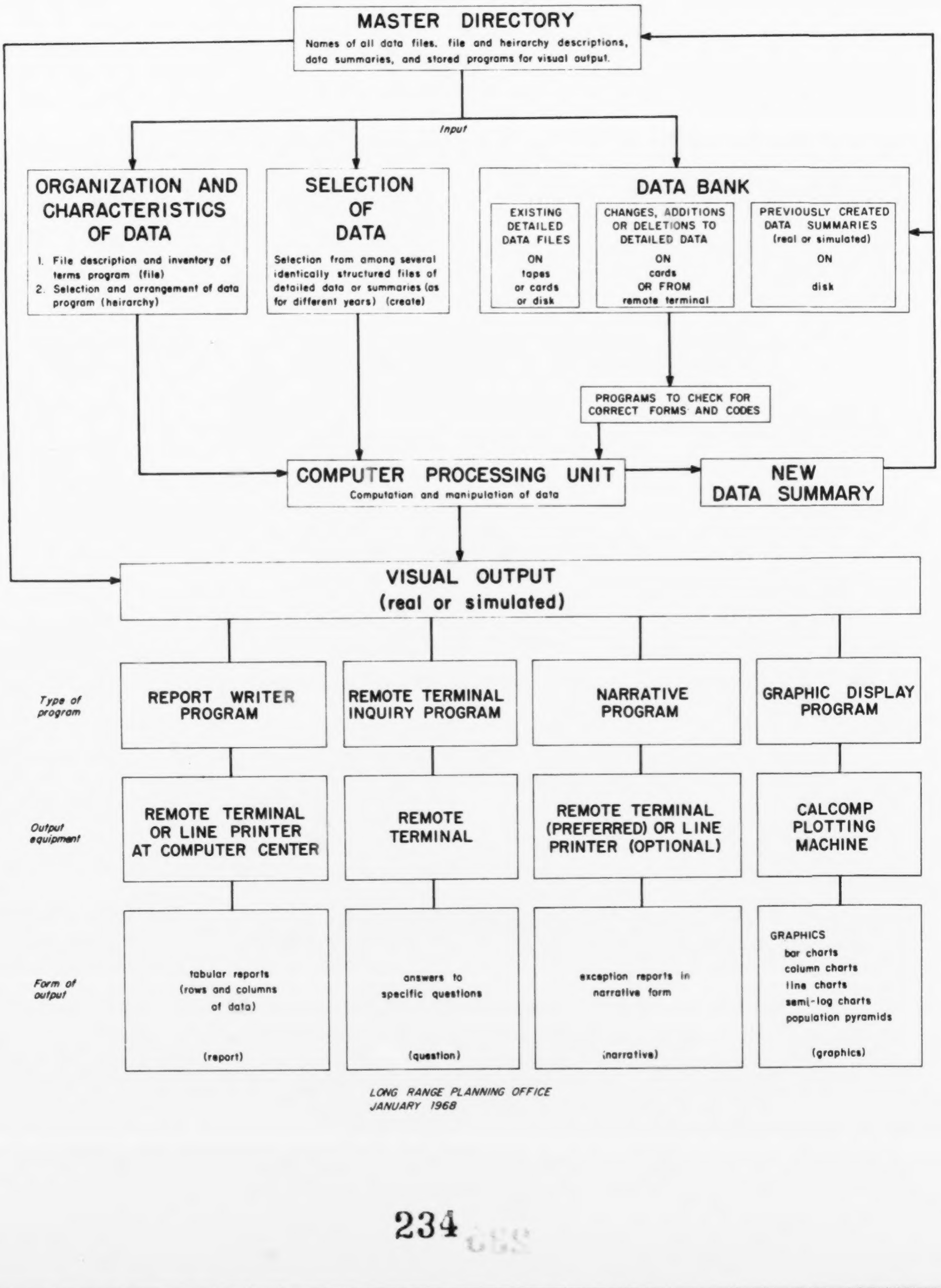
It will be possible to create new files of simulated data, based on the old files, holding some input factors constant, and varying others, as desired, in order to study the resulting changes elsewhere in the system. It is this aspect of the project, of course, which will be of most use to campus planning. It will make possible quick answers to those "What would happen if. . ." type questions referred to earlier.

Remote Terminal Inquiry--This portion of the project will design and test methods of retrieval of information from the data files in the computer through a remote terminal. A typical remote terminal is in the form of a teletypewriter of the sort found in many business offices. Its keyboard is much like that of a standard typewriter. A computer program is being written that will permit inquiries to be made of the computer data bank by typing on a remote keyboard. Requests would be stated in standard English words, such as "How many freshman female out-of-state mathematics majors live in residence halls?" In a few seconds the computer would search the files, perform any necessary calculations, and send the answer back to the remote terminal where it would be typed on the teletype paper roll. While one may not be able to think of any worthwhile use of this specific information offhand, it is an example of the type of complex inquiry which could be made of the data bank and which would receive almost an instantaneous

Figure 2

UNIVERSITY MANAGEMENT PLANNING MODEL
DIAGRAM OF COMPUTER PROGRAM RELATIONSHIPS

UNIVERSITY OF WASHINGTON


MASTER DIRECTORY
Names of all data files, file and heirarchy descriptions, data summaries, and stored programs for visual output.
Input
ORGANIZATION AND CHARACTERISTICS OF DATA
1. File description and inventory of terms program (file)
2. Selection and arrangement of data program (heirarchy)
SELECTION OF DATA
Selection from among several identically structured files of detailed data or summaries (as for different years) (create)
DATA BANK
EXISTING DETAILED DATA FILES ON tapes or cards or disk
CHANGES, ADDITIONS OR DELETIONS TO DETAILED DATA ON cards OR FROM remote terminal
PREVIOUSLY CREATED DATA SUMMARIES (real or simulated) ON disk
PROGRAMS TO CHECK FOR CORRECT FORMS AND CODES
COMPUTER PROCESSING UNIT
Computation and manipulation of data
NEW DATA SUMMARY
VISUAL OUTPUT
(real or simulated)
Type of program
REPORT WRITER PROGRAM
REMOTE TERMINAL INQUIRY PROGRAM
NARRATIVE PROGRAM
GRAPHIC DISPLAY PROGRAM
Output equipment
REMOTE TERMINAL OR LINE PRINTER AT COMPUTER CENTER
REMOTE TERMINAL
REMOTE TERMINAL (PREFERRED) OR LINE PRINTER (OPTIONAL)
CALCOMP PLOTTING MACHINE
Form of output
tabular reports (rows and columns of data)
(report)
answers to specific questions
(question)
exception reports in narrative form
(narrative)
GRAPHICS
bar charts
column charts
line charts
semi-log charts
population pyramids
(graphics)

LONG RANGE PLANNING OFFICE
JANUARY 1968

reply. Remote terminals can be used not only to provide short answers to specific questions but also to print out complete reports.

There should be a great potential for remote computer terminals located in various administrative offices on a campus. An important secondary benefit of the development of a computer simulation model as a planning tool is the creation of an instantaneously accessible and up-to-date data bank. If such a data bank is accessible from a variety of locations, many of the problems of reconciling conflicting information would be eliminated. It would be good to know that all requests for information would be receiving the same answers.

Graphic Display--The last aspect of the current project involves experimentation with means of creating machine-produced graphic displays of various information from the data bank and from simulated patterns of growth. Programs are being developed which will use computer data and a CalComp plotter to produce line graphs, semi-log graphs, column charts, bar charts, and three-dimensional graphs, from simple commands.

Work thus far on this project strongly indicates that procedures such as these should be common practice on college campuses before many years pass.

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